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THE BRICKBVILDER

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THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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ENAMELS ON BURNT CLAY.

THERE appeared in *Harper's Weekly*, a short time since, a very interesting account of the artistic porcelain and pottery makers of Japan, from which it appeared that their industry is by no means a thing of the past, but on the contrary exceedingly alive and growing all the while, and that many of the effects, such as the peach blows and the *sang de bœuf*, which have been the despair of modern manufacturers, are imitated so cleverly by the modern Japanese artists that the best connoisseurs are sometimes at fault. Following this article we had occasion to pay a visit to a large tile works in a neighboring city, and were greatly interested and pleased at the results which were there being accomplished, as well as at the similarity of methods and aims which we found as compared with those of the Japanese artists. We doubt if, on the whole, there has ever been a time within the past few centuries when the ceramic arts were in as prosperous and promising a state as they are now; and if we can judge of the future by the past, the United States will in the next one or two decades produce work of a quality which will hold its own not only with the work of our cousins in Germany and England, but with the more imaginative work of the Japanese artists. We have seen bits of porcelain, examples of glazes and enamels, which were thoroughly in the spirit of the Oriental work, and the natural possibilities of our soil are sufficient to satisfy the demands of the most exacting artists.

The difference between our enameled terra-cottas and the delicate work of the Mongolians is one of application and fineness of workmanship rather than of material, and although we do not usually class Canton tea-cups or Imari ware with such prosaic products as enameled bricks, the artistic, decorative, and practical possibilities of the Japanese potter are all implied in the capacity for the production of first-class enamels laid over burnt clay. Our recent national development has been especially promising along these lines and there have been some notable works produced in enameled terra-cottas and glazed bricks which show not only the capabilities of our manufacturers, but appreciation on the part of our architects and constructors of the capabilities of this fascinating material. We call it a fascinating material, for we have yet to know of a designer who has made a serious attempt to use it who has not sooner or later developed a mania for it. The color possibilities are so large and the effects produced thereby are so permanent that there is no other one medium which is on the whole so satisfactory. The designation, enameled brick or terra-cotta, usually suggests to most minds a perfectly bare uninteresting white wall with a glossy slippery surface. Our manufacturers, indeed, take a pride in the purity of the white enamel which has been applied to bricks and terra-cotta, but the palette of the designer in enamels is so large that almost any color effects can be produced, and we have recently seen some examples wherein blues, reddish browns, and greens have been used with very marked success. The stations of the Subway are lined with a very high grade of enameled brick and tile, and for white work they are very successful. A feeling is manifested at times that so long as enameled brick and terra-cotta is given a half-hearted opportunity in back halls, boiler rooms, and lavatories, that is all the manufacturers could reasonably expect; but if there be infused into the design some of the elements which make the Japanese ceramics so fascinating, there is not the slightest reason why such material could not be adapted for some of the best uses. The Reading station in Philadelphia has in one of the large waiting rooms a considerable quantity of most excellently designed and manufactured enameled terra-cotta work in strong colors and carefully elaborated designs. There is a private hotel in Boston in which the vestibule is treated in enameled terra-cottas, one of the earlier examples, but in a limited way quite satisfactory, and interesting in showing what might be done if the public and our designers were educated to a proper use of a certain material. More recently the baptistery of one of our large city churches has been finished throughout in enameled ware, in low relief, with a very successful color treatment. There is, of course, no lack of historical precedent even closer at hand than Japan for applying this material in the choicest work, but we are only beginning to use it understandingly.

We must not think of enameled brick and terra-cotta as a constructive material at all, but rather treat it purely as a finish, as a material which will take the touch of the designer and the sympathetic tones of the colorist, and will hold both for generations after the color of marble or stone have faded entirely away. A handicap which our manufacturers have been under in the past is the extremely limited market for a really first-class product. The English glazed bricks, — and, by the way, we imagine some of our readers would be surprised to know that some of the best English glazed bricks are made by the Hon. Mr. Gladstone, — set the pace in this country for many years, and our manufacturers thought the limit of their skill was reached when they equaled the foreign production. But we can now do better than that. It is not unfair to say that we have a certain measure of the artistic sense which has made the Japanese pot-

teries so famous, and when the public can appreciate more truly what exquisite effects can be produced in enamels and glazes, and how artistic a combination can be made with these materials applied to colored terra-cottas, it will not be necessary to finish our vestibules in mahogany to secure a rich effect, nor will enamel work suggest nothing more interesting than a perfectly uniform creamy white surface. The prime recommendation of terra-cotta was formerly that it was cheap. Now it ranks as the foremost art industry associated with the building trades; and in like manner its companion, enameled and glazed terra-cotta, can become one of the most notable mediums in which the artist can express the subtlest designs and produce the most permanent rich effects. We have always had a great faith in this material, and believe that the time will come when terra-cotta more generally will be enameled or glazed before it is applied to our commercial structures. The enamel will keep its color intact, and if we may judge by examples which have come down to us from the medieval period, there is no limit to the life of even the most delicate tones.

THERE are begun in this issue three articles of more than passing interest. To those familiar with his earlier work on "Masonry Construction," the paper on "The Strength of Brick Masonry," by Ira O. Baker (M. Am. Soc. C. E., Professor of Civil Engineering, University of Illinois), will be a welcome contribution upon this subject. The paper will be concluded in the April number.

"How to Build Fire-proof" forms the basis of an article by Francis C. Moore. As president of the Continental Insurance Company of New York, and delegate of the New York Board of Underwriters to the Board of Examiners of the New York Building Department, Mr. Moore has had exceptional opportunities to observe the efficiency of the various methods intended for fire-proofing, as well as the deficiencies in plans and construction of many of the so-called fire-proof buildings, hence his deductions and recommendations will be found to be of especial interest and value. Mr. Moore's paper will be concluded in the April number.

A paper "On the Saline Efflorescence of Brick, the Causes Leading to It, and the Practical Means of Avoiding Same," by Oscar Gerlach (Ph. D., Berlin), will commend itself to those who have experienced the annoyance which results from this disfigurement of brick wall by the accumulation of efflorescence, or scum, upon the brick. Prof. Edward Orton, Jr. (Department of Ceramics and Clayworking, Ohio State University), endorses this paper by Dr. Gerlach as being of "great practical and scientific value."

The printing of these papers in this number has necessitated the discontinuance of the Mortars and Concrete Department for this month.

PERSONAL AND CLUB NEWS.

ARTHUR CONNELLY, architect, Newark, N. J., has removed his office to 673 Broad Street. Catalogues desired.

ALFRED H. GRANGER, of Granger & Meade, architects, has withdrawn from that firm and removed to Chicago, where he has formed a partnership with Charles S. Frost. Mr. Meade has formed a partnership with Mr. Abram Garfield, under the name of Meade & Garfield, at 731 Garfield Building.

OWING to the death of Mr. Forrest A. Coburn, of Coburn & Barnum, the firm of F. S. Barnum & Company, architects, has been organized, with the following members: Frank S. Barnum, Harry S. Nelson, Albert E. Skeel, Herbert B. Briggs, and Wilbur M. Hall, with offices in the New England Building.

BOHEMIAN NIGHT was observed by the Chicago Architectural Club, Monday, February 28. The entertainment was arranged by Messrs. Richard E. Schmidt, Arthur Heun, Chas. E. Birge, A. G. Zimmerman, Myron H. Hunt, John B. Fischer, Adolph Bernhard, and E. H. Seaman, who served as hosts for the evening.

THE third annual banquet of the Cleveland Architectural Club was held at the Hollenden, January 20. President Herbert B. Briggs was toastmaster, and responses were made by Messrs. J. N. Richardson, Stephen C. Gladwin, Chas. W. Hopkinson, W. Dominick Benes, Louis Rohrheimer, and Starr Cadwallader. A feature was the presence of the ladies.

A REGULAR meeting of the T Square Club was held on Wednesday evening, February 16. The program of the competition for the evening, entitled "The Nucleus of a Town," had been arranged by Mr. Edgar V. Seeler, who led the criticism on the drawings submitted, and spoke in an interesting way on the possibilities of the general planning of cities.

The mentions were awarded as follows: First, Ira E. Hill; second, Arthur S. Brooke; and third, W. P. Trout.

ON Monday evening, February 21, Mr. H. J. Maxwell Grylls spoke on "Roman Architecture," the third paper of the series on the "History of Architecture," at the Museum of Art, Detroit, before a liberally attended and appreciative audience. It was well illustrated by stereopticon views, and drawings by members of the club.

The public are greatly interested in these lectures and take advantage of the opportunities offered.

The next paper will be given, March 7, by Mr. James E. Scripps, on "History of Gothic Architecture."

ILLUSTRATED ADVERTISEMENTS.

FISKE, HOMES & CO., in their advertisement, page vii, illustrate number nine of their series of brick and terra-cotta fireplace mantels.

The new Telephone Building at Cleveland, Ohio, C. F. Schwein-

PANEL, SCHOOL BUILDING, 108TH STREET AND AMSTERDAM AVENUE, NEW YORK.
C. B. J. Snyder, Architect.
Executed by the New York Architectural Terra-Cotta Company.

furth, architect, is illustrated in the advertisement of Harbison & Walker Co., page xiii.

Some interesting Chicago buildings roofed with Celadon tiles are shown in the advertisement of the Celadon Terra-cotta Company, Charles T. Harris, lessee, page xxvii.

The American Schoolhouse. V.

BY EDMUND M. WHEELWRIGHT.

IN a pamphlet on "The Construction of Schoolhouses," published in 1895, Mr. Edward Atkinson gives the following "rough and ready computations upon the cost of schoolhouses," constructed upon the principles of "mill construction."

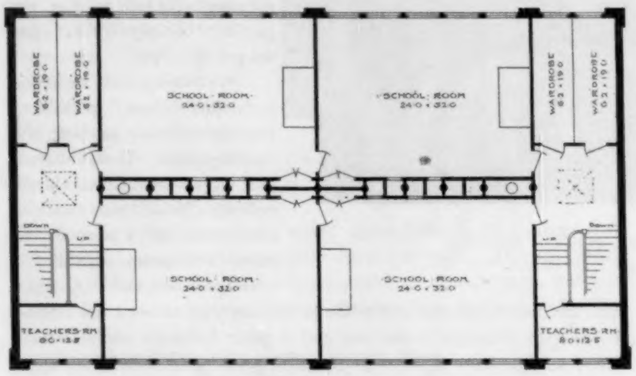
The leading idea of this pamphlet is that schoolhouses are made needlessly expensive on account of expenditure for architectural effect, and that there are conditions of essential economy in so-called "mill construction" which make the use of this method one of radical economy. Careful consideration of the schoolhouse work of several architects and my own experience leads me to a contrary opinion as to both propositions. While there are a few cases to be found where the expenditure for architectural effect on schoolhouses has been somewhat greater than good economy, if not the best taste, would suggest, in the main the increased cost of a pleasing architectural design bears but a very small proportion to the cost of a well-constructed schoolhouse. The elements upon which good effect depends are found in the very conditions of the problem, and with but small expenditure above absolute needs, a skilful designer can bring a satisfactory result. The additional expense mainly comes out of the pocket of the architect, who seeks to give proper proportion and expression to the structure entrusted to him.

As to the greater economy of "mill construction" above that commonly employed, I believe that all who have calculated the cost of the two have found that "mill construction" is slightly more expensive, and has the disadvantage of being troublesome on account of shrinkage of the large-sized stock, and the advantage of being practically safe from danger to the inmates from a fire in the basement.

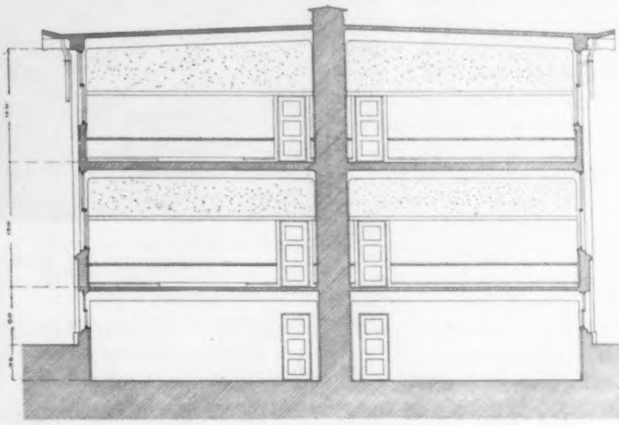
As to the use of thinner brick walls than ordinarily employed, this is not an essential characteristic of "mill construction," and, indeed, the use of 8 in. brick walls is not to be recommended if plastering is to be laid directly thereon as it should be as a fire and vermin precaution. An exposed interior wall, if painted and properly constructed to receive painting, does not make for economy as against a plastered brick wall.

Mr. Atkinson states that "in a broad and general way one may compute the cost of a school building, without plumbing and appliances, midway between the cost of the factory building and the hospital" constructed on the "mill" principle. "That would be $1.35 per square foot of floor, counting all floors.

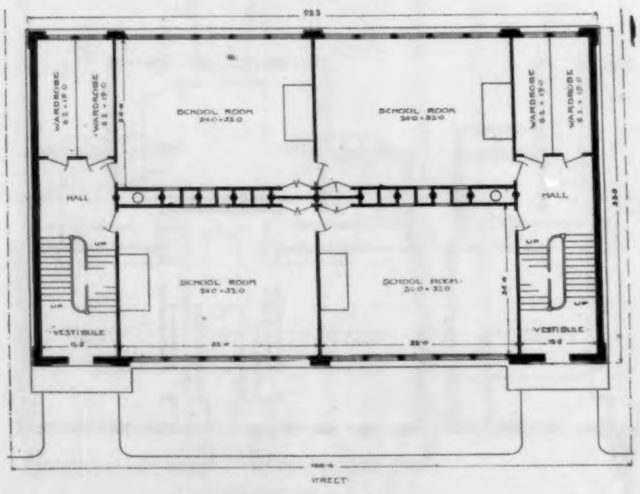
"The schoolhouse of least cost in construction would be one placed on a moderate slope, consisting of basement story and two floors to be occupied by pupils, the main entrance being on the lower side of the slope by a door into the basement, the stairway being wholly within." These conditions are, by the way, not to be considered sufficiently normal to serve as a basis for consideration of cost of a typical schoolhouse, and they have not been strictly followed in the plans of Mr. William Atkinson, here shown, which are published at his request to illustrate the type of building contemplated by his father's pamphlet. The plan described in the pamphlet indicated that of a building with a central entrance, which would have necessitated that the schoolrooms would give off a



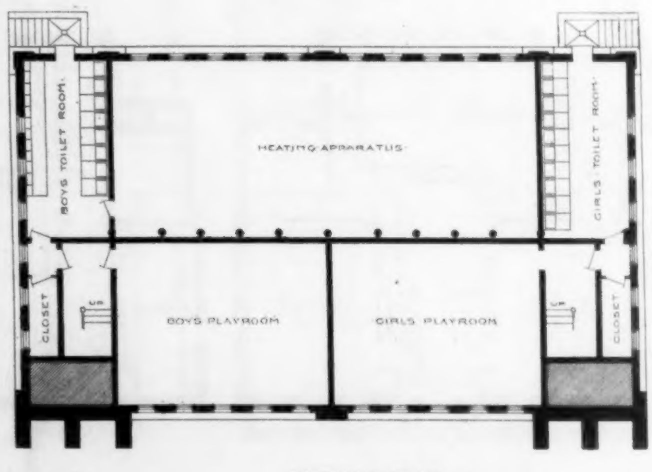
SECOND FLOOR PLAN.



SECTIONAL VIEW.



FIRST FLOOR PLAN.



BASEMENT PLAN.

PRIMARY SCHOOLHOUSE.
William Atkinson, Architect.

common corridor and would have required that the two staircases should have been placed in staircase halls at right angles to the main corridor, which is practically the same plan as that shown in the Wyman School. Mr. Atkinson's plan differs in two essential points from the accepted arrangements of our graded schools. First, certain schoolrooms can be reached from others only by passing through a third schoolroom, and all the "wardrobes" are not placed in conjunction with the schoolrooms for whose pupils they are designed.

Each of these variations from accepted conditions are nonconducive to the ready maintenance of order and discipline as well as convenience.

Mr. Atkinson's plan contemplates the use of 12 in. brick walls for first story and 8 in. brick walls for second story. The central floor support by steel columns and girders has the objection of cutting through the heat and ventilation pipes, and of increasing the expense of construction over that given by a brick carrying wall.

EUSTIS STREET PRIMARY SCHOOL, BOSTON.
Edmund M. Wheelwright, City Architect.

"We will assume," says Mr. Atkinson in his pamphlet, "an eight-room schoolhouse in which the pupils are to be provided for on two floors of four rooms each, such schoolrooms to be of the dimensions of 28 by 32 ft. each, for the accommodation of 56 pupils each,—or 448 pupils in all. Four rooms of 28 by 32 ft., 896 sq. ft. each room, would require in all, square feet of floor 3,584

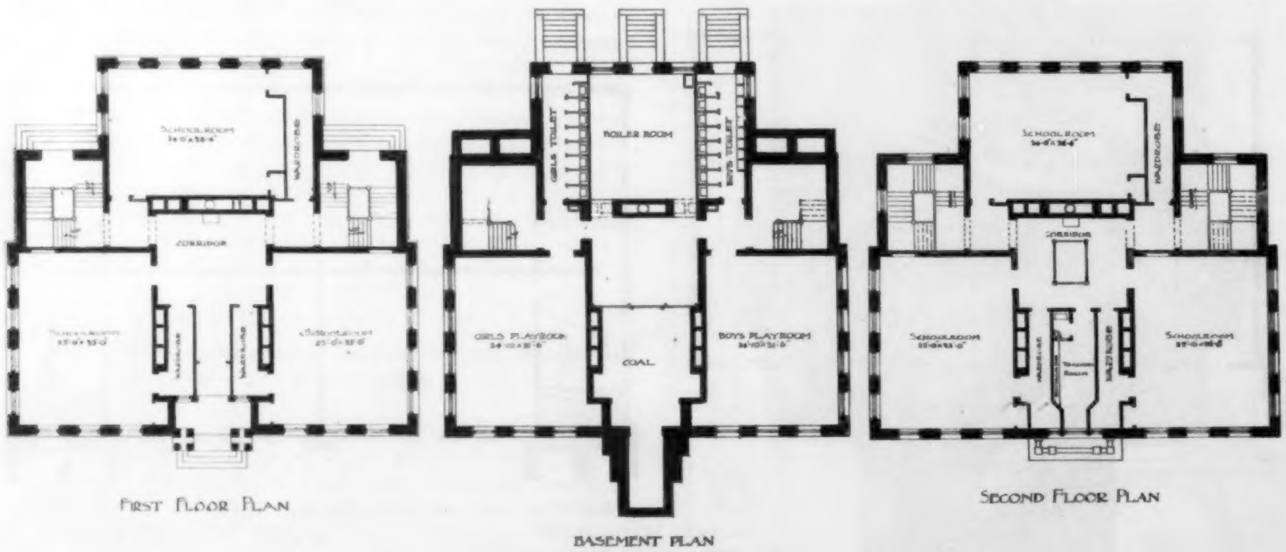
"We find that the minimum of hallway, stairway, teachers' room, and lavatories bears the proportion of 60 per cent. to the space in the schoolrooms on each floor. That would add square feet of floor 2,150

The basement would therefore cover square feet of floor	5,734
First floor	5,734
Second floor	5,734

"We assume that this building is to be covered by what is called a flat roof, that is to say, a roof of ½ in. pitch, without any enclosed space above it. The total floor area, therefore, comes to, square feet of floor . . . . 17,202 divided by the number of pupils, this gives 38.56 sq. ft. to each pupil.

"We will add for contingencies and assume that there would be 40 ft. to each pupil in such a building. At the midway ratio between the factory without plumbing and appliances, and the hospital with plumbing, heating, and all appliances, $1.35, this would bring the cost of a brick building of the most substantial kind to $54 per pupil. Multiply by 448 and we get $24,192.

"To this should be added architects' fees, plumbing, heating, ordinary grading, and contingencies. It would seem as if 25 per cent. added should suffice. If so, we reach a total cost of $30,000. In some instances, notably in crowded cities, the size, situation, and neighborhood may make it necessary to arrange the schoolrooms with reference to the sun, and to place hallways and stairways where a larger area than 60 per cent. of each floor will be occupied by them. In that case, the additional number of square feet of floor must be added at the normal rate of cost per square foot. I am unaware whether or not that cost is greatly more or less than the cost of buildings previously constructed to meet a similar want. The only test of these estimates is that plans and specifications should be made upon these lines for submission to any one of the thoroughly competent builders who will not scrimp the work or vary from the highest standard in every respect. My judgment is that this estimate can be attained in practise in the city of Boston, subject to such additional expense as may be imposed by compliance with the building act."

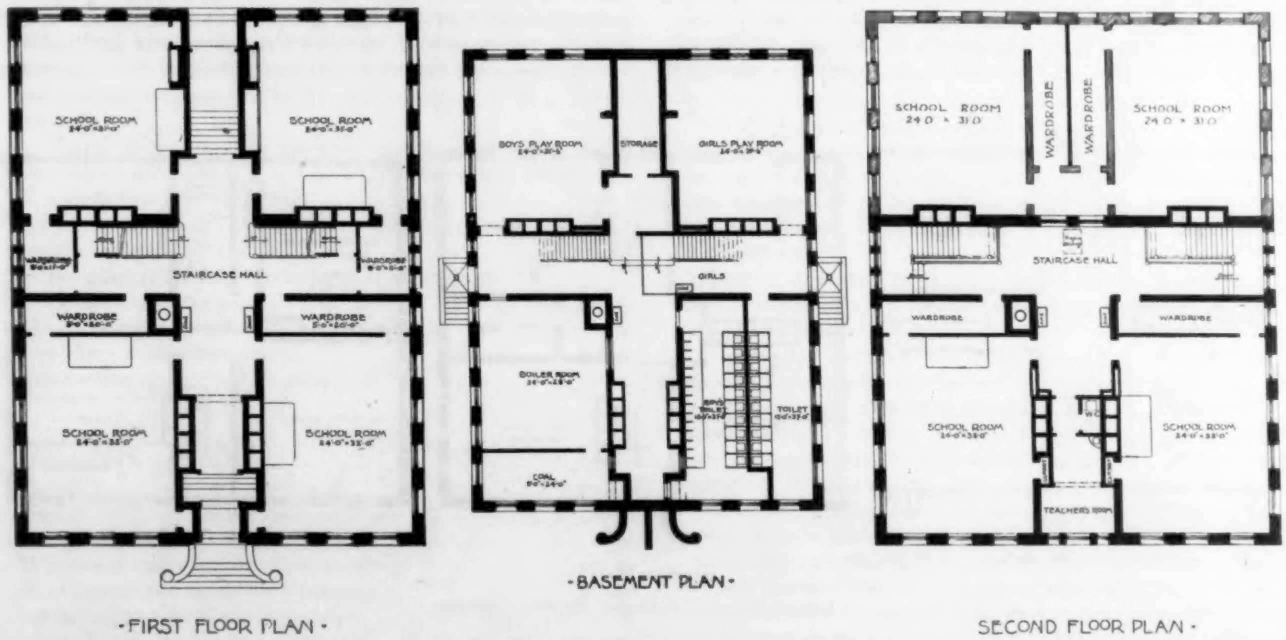


EUSTIS STREET PRIMARY SCHOOL, BOSTON.

It will be noted that the dimensions of the schoolrooms shown in the plan here published are 24 by 32 ft., and not 28 by 32 ft., as premised in the pamphlet; but, as the architect writes me, if the size of the rooms were thus increased in the plans under consideration, the total floor area of all floors, including walls, would be about that given in the pamphlet, *i. e.*, 17,202 sq. ft.

WYMAN STREET PRIMARY SCHOOL, BOSTON.
Edmund M. Wheelwright, City Architect.

Mr. Atkinson is of the opinion that such a structure as that contemplated by his plan, but with rooms of the larger size, can be constructed outside of Boston, not including plumbing and heating, for about $1.30 per square foot of floor area. He would use iron staircases, slate blackboards, fire-stops and expanded metal partitions, and wire-lathed ceilings. Aside from the excess of cost of requirements of the Boston Building Laws previous to 1892, the school would differ little in its features from those of Boston schoolhouses built about that time. The only points of such difference would be single instead of double sash, wood instead of cement and plaster finish, ordinary base in place of hospital base; for all the Boston schoolhouses built at this time had "mill-constructed" first floors.



WYMAN STREET PRIMARY SCHOOL, BOSTON.

Such being the case, it is difficult to see how Mr. Atkinson's expectations of cost can be borne out in an actual construction of such a building as he has planned. As this building he suggests is of a very unusual and not normal form of schoolhouse plan, it would appear more fruitful of satisfactory result to consider first the cost of an eight-room schoolhouse of a more normal type.

Let us then consider the cost of the Wyman School built in 1891 and 1892 in Boston. It is a building of very simple type, with mill-constructed first floor, flat tar and gravel roof, and of such slight architectural pretensions as to bring it very close to the category of a factory building. It is a six-room building, but, planned for the ready addition of two more schoolrooms, the additional cost of such further construction, if done at the time of the first construction, would have been, say, $2,000 additional to the actual cost, or about $30,000. Mr. Atkinson's estimate of $1.35 per square foot of floor area did not contemplate the cost of heating and plumbing. These features of the Wyman School cost about $3,200, making the cost under consideration about $35,000.

The floor area of the Wyman computed as an eight-room school was 15,744 sq. ft.; its cost per square foot of floor area without heating or plumbing was, therefore, about $2.27.

If this building had been built for grammar grade, with schoolrooms 28 by 32 ft. instead of 24 by 32 ft., its cost would have been increased about $1,500, or about 10 cents per square foot, that is, to $2.37 as against $1.35, the price set by Mr. Atkinson as the price for his mill-constructed school of this type.

The heavier brick walls required in the Boston school above that of the mill-constructed school involved an increased expenditure of about $2,200; the cost of asphalt floor above concrete, double instead of single sash, and other items of more expensive finish, involved not more than $1,800 in addition; and if the slight departures from the strict requirements of necessity in external features

did not amount to more than $700, I am safe in saying that no saving would have been made if columns and girders had been substituted for brick carrying partitions, but possibly $1,500 might have been saved by not using brick vent and heat flues, and some of the non-carrying brick walls.

About $6,200 is all the saving that would appear if the building had been constructed under building laws that would have permitted the construction upon which Mr. Atkinson bases his calculations.

The area of an eight-room grammar school building, on the same plan as the Wyman School, would have been about 18,000 sq. ft. If a building of this plan were constructed as Mr. Atkinson suggests, we would expect its cost to be about $31,500, or, $1.75 per square foot of floor area. I cannot, judging from my own experience in the cost of actual construction, believe it possible to reach the low cost of $1.37 per square foot of floor area given in the pamphlet.

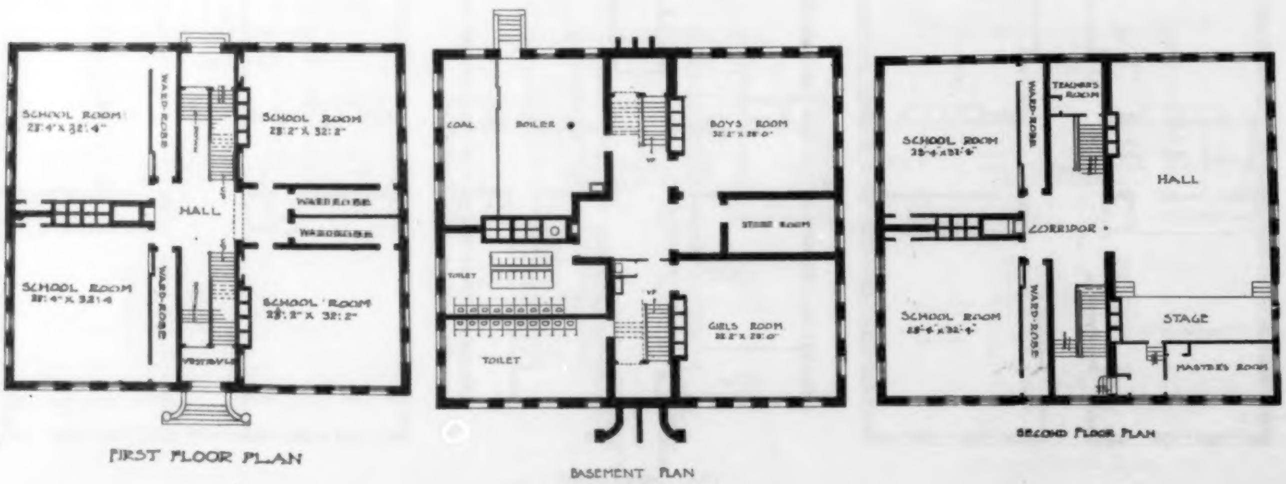
Let us consider another Boston schoolhouse of very plain external treatment,— built at the same time as the Wyman School,— the Warren Grammar School. As this is a six-room building with an Exhibition Hall, it is practically the equivalent of an eight-room building. This building contains 18,648 sq. ft. of floor area, and cost, exclusive of heating and plumbing, about $35,000. It is even plainer in design than the Wyman School, and if the deductions on account of extra thickness of walls and other variants from Mr. Atkinson's hypothetical school are made, we may set the minimum cost of such a building at about $30,500, or about $1.64 per square foot of floor area.

This could again go to show that such low cost of schoolhouse construction as calculated in the pamphlet and by the estimate of the schoolhouse indicated by Mr. Wm. Atkinson's sketch plan is impossible, even if other than "thoroughly competent builders, who will not scrimp the work or vary from the highest standard in every respect," are employed. There is an evident fallacy in the method of striking the mean between the cost of a factory and the cost of a hospital as the basis of cost of a schoolhouse. There are no such elements of a greater cost in a hospital above that of a schoolhouse which would justify such a basis of computation; indeed, the greater floor spans required in a schoolhouse make this class of building little if any more expensive than a hospital of the same grade of workmanship and architectural (or non-architectural) treatment. In my own experience I have found but little difference of cost in schoolhouse and hospital construction.

NORTH BRIGHTON GRAMMAR SCHOOL, BOSTON.
Edmund M. Wheelwright, City Architect.

In a schoolhouse expense for fire protection and for hygienic reasons is equally if not more necessary than in a hospital. The expense of blackboards fully offsets the expense of marble fittings in the ordinary operating room.

The cost of $1.64 per square foot of floor, is, I believe, the minimum cost at which a small grammar schoolhouse, two stories in height, can be built, if constructed as contemplated by Mr. Atkinson's plan. Any departure from the regularity of this plan, or the addition of any of the desirable features not contemplated therein, will make an additional cost.



NORTH BRIGHTON GRAMMAR SCHOOL, BOSTON.

It should be borne in mind that this cost does not include heating or plumbing. These items will add about 22 cents to the cost per floor area; and the cost of the double sash, with the thicker walls necessitated thereby, asphalt floors and other features requisite for a schoolhouse of the first class, will add 10 cents additional. We may, therefore, set the minimum cost of an eight-room schoolhouse built in a first-class manner, with all features desirable for health of pupils and permanency of construction, and with no architectural pretension, at $1.96 per square foot of floor area, if the building

is of as compact a plan as the Warren School; and that as the area is increased in meeting the same conditions, that the cost is increased by about $1 a square foot of such added floor area.

Let us apply this method of estimating to a building of the area of the school predicated in the pamphlet.

The Warren School had 18,648 sq. ft. of floor area, which, at $1.96, amounts to $36,550. The Warren School has more floor area than the school described in pamphlet by about 1,500 sq. ft., which, at $1 per square foot, would decrease the probable cost of such a building to $35,000; the cost of grading, paving, and fencing the schoolyard of such a building would probably not be less than $3,500. The architects' commission would be $1,925, making a probable total cost of first-class, well-constructed, eight-room grammar school not less than $40,425, and which, if shorn of certain desirable features not contemplated in Mr. Atkinson's program, could not cost much less than $38,000, instead of $30,000, which is stated in the pamphlet to be the probable cost of such a building. I regret that further communication received from Mr. William Atkinson cannot be printed in this issue, but it will be given in the next paper.

It has appeared desirable to analyze this subject for two reasons: First, to, if possible, lessen the number of adherents to the idea that the expense of schoolhouse construction is greatly increased through regard for architectural appearance, which appears to be the main point which Mr. Atkinson has sought to establish; and, secondly, to remove the impression which this pamphlet has produced upon the minds of some, that thoroughly appointed and well-constructed schoolhouses are extravagant in cost, because they are found not to tally with the calculations there found. The question of the amount of cost due to architectural design in schoolhouses and the general artistic views of this subject will be later considered.

To follow out further this consideration of schoolhouse costs, the following table relating to a six-room schoolhouse built in Boston under the Building Laws of 1892 is given. The increased size of building due to these laws will be noted, in comparing the plans of the Eustis and Fuller Schools, to be due to the requirement of the later law that staircases should be enclosed and shut off by tinned fire doors.

Three items here given show the excess of cost of method of construction and features in Boston schools of that time above those of schools outside of that city.

Greater thickness brick walls	$1,173.00
Increase through special requirements of law as in relation to enclosed staircases, etc.	1,500.00
Floor framing to carry load of 150 instead of 80 lbs.	1,000.00
Iron above wood staircases	468.00
Fire-proofing of floor and fire-stops	300.00
	$4,441.00

Wardrobes in separate rooms	$1,600.00
Double instead of single run of sash	420.00
Asphalt instead of cement basement floors	500.00
Fire-proof instead of stud partitions	121.00
Wire-lathed instead of wood-lathed ceilings	296.00
Slate instead of composition blackboard	209.00
Keene's cement finish instead of wood	96.00
Hospital instead of common base	106.00
Bookcases and other special finishings	180.00
	$3,528.00

These tables will be found useful in comparing the costs of different schools, but in such use it should be borne in mind that costs of schoolhouses vary on account of the number of schoolrooms, and also whether built for primary or grammar grades. This will be pointed out in detail later and an attempt will be made to fix certain proportions by which calculations may be made from one grade to another and from smaller to larger buildings, and *vice versa*.

Architectural Terra-Cotta.

BY THOMAS CUSACK.

COOPERATION BETWEEN ARCHITECT, ENGINEER, AND CLAY WORKER.

IT has already been assumed, as a matter of course, that the first step towards the erection of a building is to employ a competent architect; not only to plan, but to supervise its erection. If the building is one on which structural iron (or steel) is to be used, he will require the help of an equally competent engineer. There are many ways in which such help may be obtained, but the usual course of procedure resolves itself into a choice between three alternatives. First, he may associate with himself a consulting engineer of repute, who takes charge of the constructural ironwork, and for which service is paid a separate commission. Second, he may employ competent help of this kind to work in his own office at fixed salaries. Third, he may arrange with a capable, trustworthy firm of contracting engineers, who will devise a scheme of construction; for which, as well as for the execution thereof, they will hold themselves responsible, subject to agreement as to cost.

On the relative merits of these three systems a divergence of opinion may reasonably be expected; but as the terra-cotta man is sure to have enough troubles of his own, he had better ask to be excused from any part in a question that does not directly concern him. He is not called upon for advice in regard to the steel structure as such, except in so far as his own work is likely to be affected; and in that it is mechanical rather than business methods that he is forced to consider. Forced, we say, for a stage has now been reached where the settlement of these points is to him and his work a matter of vital importance. It often happens that they have been settled *for* him; sometimes, indeed, before he has obtained the contract for his part of the work, or, at all events, before he has seen the details or has had time to make any recommendations concerning them. If settled in this way, the chances are that the best possible solution has not been thought of, because the man best qualified to render needful assistance, by reason of his special knowledge and experience, has not been consulted. In this we do not impute intentional discourtesy to either architect or engineer; nor do we charge them with any desire to discount the claims, much less ignore the existence of a terra-cotta maker. As a general rule, the facts warrant a distinctly opposite conclusion. It is the *system* under which contracts are usually awarded that is responsible for most of the anomalies that arise in the course of their fulfilment.

Instead of the terra-cotta being one of the first items pushed forward to a definite settlement, it is often allowed to drag until nearly the last, or until some general contractor can make satisfactory terms with one out of many subcontractors. Meanwhile, the iron construction has been determined, and is then, perhaps, too far advanced at the works to admit of any modification being made, however freely certain oversights may be admitted. They may be too palpable to be denied, but these admissions are valueless when accompanied by a statement to the effect that "the shop drawings are all out," or that "the holes have been punched at the mill," and so cannot be altered except at an expense to somebody, which nobody is willing to defray. The terra-cotta manufacturer is usually thereupon advised to do the best he can under these untoward conditions, and with that consolation is expected to rest and be thankful. In all instances of this kind he becomes a scapegoat on whose back a multitude of sins are carried into the wilderness of forgetfulness, while the iron construction, however much at fault, is allowed to pass unimpugned, as though a thing of divine origin.

There are at least two ways in which these grievances may be remedied, or — which would be better — rendered non-existent. The points of contact between iron and terra-cotta might be reserved, and held subject to revision until such time as the successful bidder has had an opportunity of assenting to, or of offering a substitute in lieu

of the proposed arrangement. The better plan, however, and we are glad to say one frequently adopted by the best architects, is to give out the contract for terra-cotta direct, and at the earliest possible date. If, for business reasons, all payments be made through the general contractor, it is a very simple matter to have that item in-

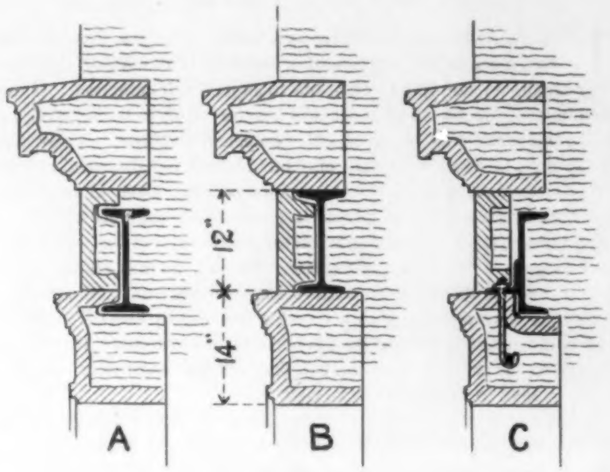


FIG. 50.

cluded in his contract. Much remains to be said on this branch of the subject, but to avoid a confusion of ideas, it is reserved for another chapter.

The questions at issue may be further elucidated by the few simple illustrations now added to those already given. If, for example, an I beam should be placed arbitrarily as at A, Fig. 50, provision would have to be made in the blocks forming lintel to receive the lower flange. To do so, however, would at once render the blocks more difficult to make, without adding any equivalent support to the lintel. In such a case the I beam should be raised, or the lintel lowered to position shown at B, thus allowing the cornice course to rest directly on beam, the fascia being molded to fit in between the flanges. If, for any reason, the relative positions of I beam and of lintel could not be altered, then a channel might be substituted, and on it an L riveted at any desired height, as at C. A lintel of this kind would be considered self-supporting up to 4 ft., beyond which width of aperture it could be suspended by hangers, inserted in the manner indicated in section, and elsewhere explained with sufficient detail.

Another objectionable arrangement is shown at A, Fig. 51, and in it, too, the remedy is, we think, equally obvious. Just why that 12 in. I beam should have been placed in its present position it is rather difficult to imagine. It cannot be supposed that a beam of that size was necessary to carry the wall above, there being but a few feet of brickwork between it and the sills of a similar tier of windows in the next story. Ostensibly it is intended as a support for the terra-cotta lintels; in reality it reduces these lintels to a shell, rendering them liable to snap along the chase made for bottom flange; manifestly the line of least resistance. Had the engineer's intention been to rob these lintels of their own inherent strength, and at the same time cause the maker of them the utmost inconvenience, he could hardly have hit upon a readier means of doing both. The truth is, he had not mastered the rudiments of the business in which he was engaged; or, having done so, acted with selfish indifference as to consequences.

The change which we would advise in all cases of this kind is shown at B. An arch lintel 14 ins. deep and 16 ins. reveal would be quite safe over an opening of 5 ft., without any auxiliary support. Beyond that width, instead of a 12 in., we would use two 6 in. I beams, placed so as to carry the brickwork above and relieve the lintel below. It is rarely necessary to insert the flange of cast or of rolled sections, and it is better to avoid doing so wherever possible, except at a joint, where it can come between two courses.

An equally objectionable use of iron is illustrated at C, Fig. 51, where a 12 in. I beam is placed so that the flange cuts into back of panel to within 2 ins. of the face. Had this beam been reduced to 8 ins., the flange could then have come into the joint, and so would not have impaired the stability of the panel. This panel, it will be observed, could not be jointed to suit the flange because of the ornament on its face, which would thereby have been mutilated beyond redemption. If, however, a 12 in. beam *had* to be used, for some structural reason not apparent in this section, it could have been placed at least 2 ins. further back, thus increasing the thickness of panel to 4 ins. at its weakest point; in which case the existence of the beam would have been less mischievous.

We can recall an instance of this kind in which the opposite course was adopted by the contracting engineer, and that, too, without any notice being given to the terra-cotta makers, whose work had been made to the original detail. Instead of moving it further back, he actually brought it 2 ins. farther out, without the least regard to the fact that the flange would then come clear through the terra-cotta panel. This, of course, was seen to be quite impracticable, but not until the work was being set; and then an expedient had to be resorted to which was not only expensive, but very unsatisfactory. Whether this unwarranted change was made in ignorance, or from sheer perversity, we know not. Perhaps he suffered from an overweening desire to get the center of beam into the center of column, and so be able to save a little by using standard connections. The excuse is certainly a lame one, but it is the best we can offer on his behalf.

At Fig. 52 we illustrate the design of a conventional balcony, such as might be projected from a second or third story window by way of embellishment. The manner in which it was constructed is likewise shown in section below; in this instance, as an example of how not to do it. In the first place, the cantilevers were of a strength out of all proportion to the load that could, by any possibility, be

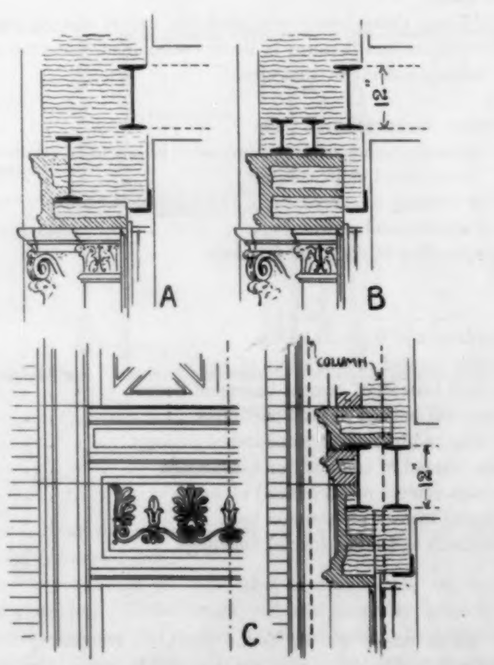


FIG. 51.

put upon them. They were placed about 7 ins. too high, cutting through the top bed of modillions and into the bottom bed of the blocks forming platform, thereby causing an incurable weakness in

both. The inverted tee resting upon them was not only quite unnecessary, but positively suicidal, so far as the terra-cotta was concerned. There is no reason why the blocks in that platform should have been severed longitudinally at this point, in order that a superfluous piece of iron might be inserted in the joint; thus creating another source of weakness no less mischievous than the one just referred to. Yet it is in this way, we regret to say, that a number of such balconies were actually constructed on a certain building of which they are supposed to be an enduring feature.

The people who made the work are conscious of these defects, but excuse themselves at the expense of the architect, alleging that it proposed construction was fairly practicable, and that it could be attempted without endangering their own reputation. If not, their next step would have been to point out its defects and offer a feasible alternative, which, in all probability, would have been accepted with thanks by the architect.

A plan such as this is shown in sections A.A., B.B., and C.C., which, being simple and direct, would have been really much less expensive in point of execution. The modillion in this case would be made with four walls and one horizontal partition, forming two open chambers, as at C.C. Into the upper one of these we would insert a 3½ by 5 in. I beam, the end of which would be attached to floor beam,

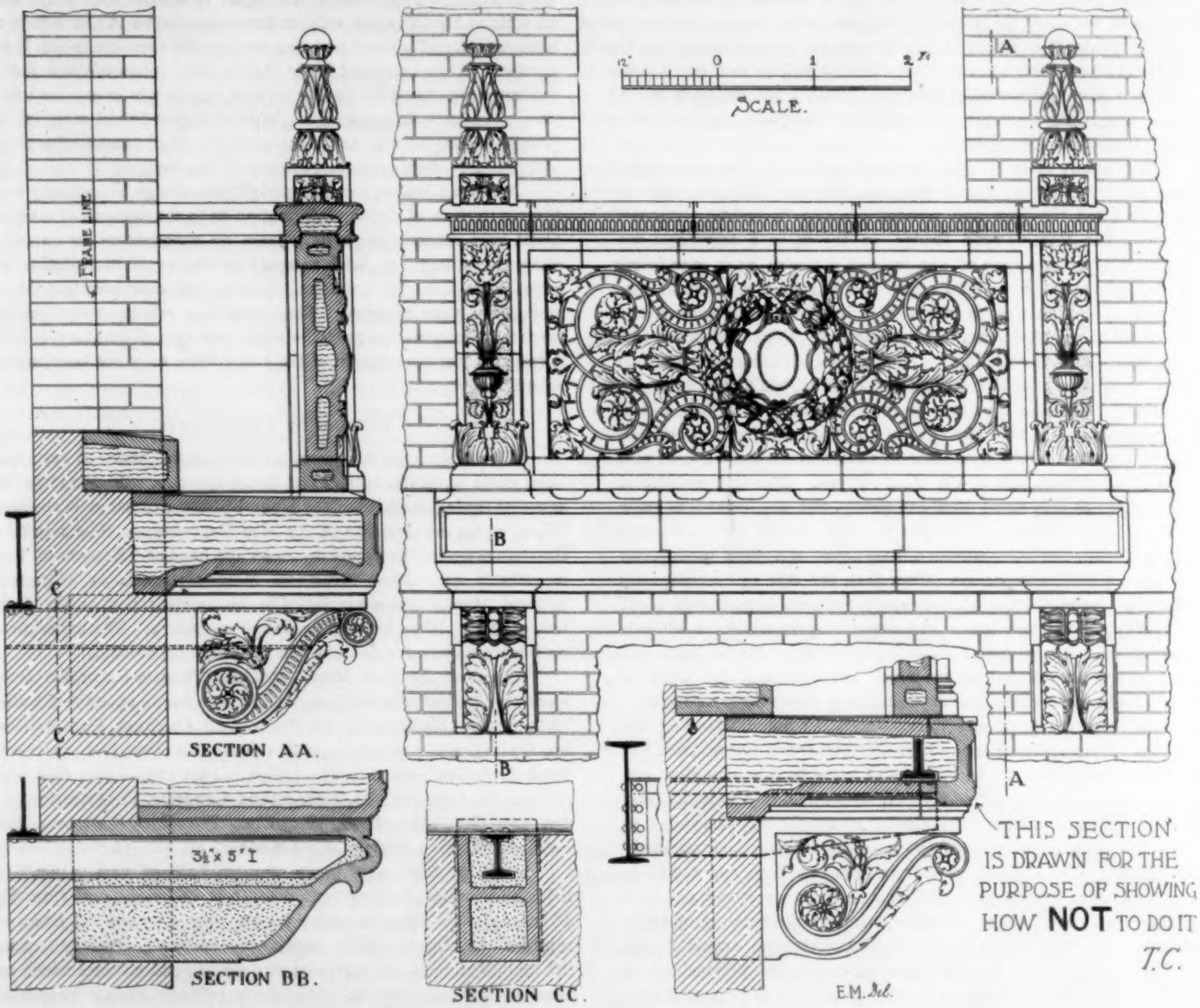


FIG. 52.

is "made according to detail." He, in turn, contends that they were long enough in the business to have known right from wrong, detail or no detail, and that, as specialists in their line, they were expected to make good just such deficiencies. On the whole, we think he has the more valid half of the argument. Meanwhile it may not, perhaps, be without reason that those best acquainted with the facts are said to prefer the opposite sidewalk.

The quality of the terra-cotta, as such, is excellent, being artistically modeled, sufficiently fired, and of good texture, but those who made it did not fully realize the extent of their responsibility. Had they done so, their first duty would have been to see that the

and the surrounding space then well filled with concrete, as at B.B. In this way we would get the full strength of the cantilever cased in cement, without weakening the modillion by needlessly cutting through its outer shell. There need not then be any doubt as to the reliability of two such brackets of composite construction. The platform would be made in three complete blocks of moderate size, two of them resting directly on the brackets, the center block joggle jointed on two sides, with a third side built into wall. As the simplicity and security of this arrangement will not be denied, it may be allowed to rest on these merits without further comment on that behalf.

Strength of Brick Masonry.

BY IRA O. BAKER.

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AN excessive estimate of the strength of a structural material results in a weak and possibly dangerous construction; but, on the other hand, a failure to appreciate the possible strength of the material used needlessly increases the cost of the structure. From the very nature of the case, the architect or the engineer is more ready to accept the second condition than the first. If he overestimates the strength of the material he uses, he endangers his own reputation and possibly the lives of others; but if he underestimates, the client pays the bill without being any the wiser. In case of doubt, it is proper to lean toward the side of safety, but the architect or engineer owes it to his client to make a safe but not excessively strong structure. This requires that the designer should know the strength of his structural materials and the method of using them most economically.

Apparently there is more extravagance in the use of masonry than of any other structural material. As an illustration of this may be cited the past and present practise in building masonry arches. The Pont-y-Prydd Bridge, in Wales, is a segmental masonry arch having a span of 140 ft., and a rise of 35 ft. (one fourth of the span), and is built of small, rough rubble masonry in lime mortar. The arch ring is only 1 ft. 6 ins. thick at the crown and the same at the springing. It was built in 1750, and after four generations is still standing. Over against this example may be cited the Westminster Bridge, in London, which has a span of 76 ft., a rise of 38 ft., and a thickness at the crown of 7 ft. 6 ins., and at the haunches of 14 ft. The span of the Westminster is about half that of the Pont-y-Prydd, and the thickness varies from five to nine and one third times that of the Pont-y-Prydd. The first is built of small stones as they come from the quarry, and the second of carefully cut large blocks. Of course the first carries only a country highway, while the latter carries a main street of a great metropolis; but even a little comparison shows that the last is extravagantly designed. Several other almost equally striking comparisons could be made between very early and more modern examples of arch construction. Again, innumerable comparisons could be made between American railroad arches which stand without any signs of failure, and others which are unquestionably many times stronger — in some cases ten or twenty times — and this notwithstanding the fact that all the evidence shows that the former are extravagant. It is nothing uncommon to find arches of considerable size that certainly have a "factor of safety" of, at least, one hundred. The cases of arches have been cited, since they are the only structures in which the ultimate strength of the masonry is even approximately approached. The load on masonry towers, mullions, piers, etc., is often still more extravagant. Of course, in many structures, particularly small ones, other elements than the strength of material determines the dimensions, and in small structures an excess of material is not important; but in larger structures the dimensions of the parts are usually determined by the strength of the material, and an excess is a serious matter.

Within certain limits it can reasonably be said that if no one of a considerable number of structures has ever failed, it is probable that some, perhaps many, of them are extravagantly designed. This principle obtains in the evolution of a machine or of a bridge. A certain part is made too small and breaks; a new and larger one is made, but after a time it also breaks; a third and still larger one is made, which does not break, at least for a long time. In this case it may safely be concluded that the part as last made is of proper design. On the other hand, if a part is made too heavy, competition or economy will prompt some one to make it smaller; and if it successfully does the work, it is proof that before it was uneconomically designed.

Did any one ever hear of a brick pier being crushed, even in a temporary structure, where it would be entirely proper to design on a smaller margin of safety than in a permanent structure? Of course, oftentimes the size of a pier is determined by its resistance to being overturned by accidental blows before its vertical load comes upon it, rather than by the load it is ultimately to support; but the fact remains that since it is very rare to find brick constructions that have failed, owing to excessive loads, it is probable that many such are extravagantly designed.

How comes it that masonry is used so extravagantly? There are two reasons: First, many designers more or less blindly follow preceding practise. Mr. A designs a structure without much knowledge of the strength of the masonry he uses. Next, Mr. B is called upon to design a structure a little higher or heavier than Mr. A's, and he adds to Mr. A's sizes without knowing whether A's structure was extravagant, and without knowing whether the increase in size is proportional to the increased load. Mr. C then treats B's structure as the latter did A's, each saying that as masonry is cheap, he will be sure to make it large enough. With a higher-priced material this process is less likely to take place, since the requirements of economy will probably determine the elements of the design.

A second reason for the unintelligent design of masonry structures is the lack of definite information as to the strength of masonry. Until very recently there have been no experiments to determine either the strength of brick masonry or the law of its variation, and even now there has been no experimental determination of the strength of stone masonry. Therefore, since existing structures give no definite information as to the actual strength of masonry, it is not surprising that the strength of brick and stone have not been utilized scientifically.

RESULTS OF EXPERIMENTS.

Within the past few years several valuable series of tests have been made upon the strength of brick masonry, with the large and accurate testing machine of the United States Arsenal at Watertown, Mass., under the direction of the War Department. The reports of the tests are published annually under the head of "Reports of Tests of Metals and Other Structural Materials made at Watertown Arsenal, Mass.," and are included in the annual report of the Secretary of War. They are also published separately. The experiments on brick masonry are described in the following volumes: —

Report of Tests of Metals, etc., 1883 (Senate Executive Document No. 5, Forty-eighth Congress, First Session), pp. 217–20; *ibid.*, 1884 (Senate Ex. Doc. No. 35, Forty-ninth Congress, First Session), pp. 69–124 and 235; *ibid.*, 1886 (House Ex. Doc. No. 31, Forty-ninth Congress, Second Session), Part II., pp. 1691–1742; *ibid.*, 1891 (House Ex. Doc. No. 161, Fifty-second Congress, First Session), pp. 739–43; *ibid.*, 1893 (House Ex. Doc., Fifty-third Congress, First Session, without a distinguishing number), pp. 323–34.

In all, 97 tests were made of piers built of various kinds of brick and mortar, varying from 2 to 10 ft. in height, and from 8 to 16 ins. square. These experiments are very valuable, but have not received the attention their importance warrants, possibly because the reports of them are scattered through several volumes which are more or less inaccessible. The above volumes contain practically only the numerical results of the experiments, and it is proposed here to discuss these experiments somewhat fully.

Kind of Brick. — Three grades of brick were used. The weakest were second-hand "medium hard-burned common brick," designated in the official report as Bay State brick. The strongest were "hard-burned common brick," designated as common brick. The best were a hard-burned, medium smooth and regular pressed brick, designated as face brick. The brick were tested by grinding the broadest surface approximately flat with loose emery on a face plate and crushing between steel pressing surfaces. The average crushing strength of the first was 11,406, of the second, 18,337, and of the third, 13,925 lbs. per square inch.

In determining the crushing strength of brick and stone it is customary to test cubes, since with specimens broader than high the

pressing surfaces materially increase the apparent strength of the material. Judging from experiments made by the writer on the relative strength of cubes and whole brick, it is probable that cubes of the above brick would have shown a strength of only about half the above results, which shows that the brick were not remarkably strong, since cubes of brick frequently test 15,000 to 20,000 lbs. per square inch, or even more.

Method of Building Piers. The piers were built by a common mason under instructions to do ordinary work. The bond was broken every course. After building, the piers were stored under a dry shed.

Age when Tested. The piers were from fourteen to twenty-four months old when tested, unless herein otherwise stated.

Strength of Lime Masonry. Nine piers from 2 to 10 ft. high and 12 ins. square, built of the weakest brick (medium-burned common brick) laid in common lime mortar, showed an average strength of 1,118 lbs. per square inch. Neglecting for the present the effect of the height of the pier, let us see if we can arrive at an adequate conception of the meaning of 1,118 lbs. per square inch. Ordinary brick masonry weighs from 120 to 130 lbs. per cubic foot, or a prism of such masonry 1 in. square and 1 ft. high would weigh not more than 0.9 lbs. Therefore, 1,118 lbs. per square inch is the pressure at the base of a wall of ordinary brick masonry 1,240 ft. (nearly a quarter of a mile) high. This is a fair average for the weakest grade of masonry experimented upon. The highest in this series was 1,270 lbs. per square inch, and the lowest 779 lbs. per square inch. Not infrequently men refuse to buy soft brick, "because they are not strong enough to bear the pressure" of a two or three story house.

Method of Failure. "The first sign of failure was the formation of cracks in the brick opposite the end joints in the adjacent courses. As the load increased these cracks gradually widened and increased in length, final failure occurring by the partial crushing of some of the brick and the enlargement of the longitudinal cracks. This manner of failure was common to all piers." In other words, the piers failed by the brick breaking across, after which the parts separated. The brick break transversely because of the irregularities of form, and because of the unequal distribution of the mortar in the joints — probably chiefly the first.

Effect of Irregularity of Form of Brick. The experiments give significant evidence as to the effect of irregularity upon the strength of masonry. Hard-burned common brick having a strength of 18,337 lbs. per square inch gave, with lime mortar, 1,814 lbs. per square inch; while face brick having a strength of only 13,925 lbs. per square inch gave a strength of 1,814 lbs. per square inch. The quality of brick is indicated somewhat by the fact that the face brick were laid with ⅛ in. joints, and the common brick with ⅜ in. The first brick were practically 10 per cent. the stronger, while the masonry was nearly 10 per cent. the weaker. With Rosendale natural cement mortar the face brick gave 15 per cent. greater strength, and with Portland cement mortar the face brick gave masonry 34 per cent. stronger than the stronger common brick. In other words, the weaker but more regular brick gave the stronger masonry. Not infrequently architects and owners, particularly the latter, reject the softer and more regular brick for the harder and more irregular, on the supposition that the latter will make the stronger wall. Within reasonable limits the reverse is more nearly true, as shown above.

(*This paper will be concluded in the April number.*)

THE subject of the John Stewardson Memorial Scholarship, the competition work for which is just commenced, is unique. A farm standing on typical Pennsylvania farm land, with barns, farmyards, gardens, etc., is the problem, and one that the ten young men now at work on it must find full of interest.

THE Pittsburgh Chapter of the American Institute of Architects are arranging for their first public exhibition. It is to be held in the Carnegie Art Galleries early in May. Many prominent architects throughout the country have already expressed their intention of exhibiting drawings.

On the Saline Efflorescence of Bricks.

THE CAUSES LEADING TO IT, AND THE PRACTICAL MEANS OF AVOIDING THE SAME.

BY OSCAR GERLACH (PH. D., BERLIN).

I PROPOSE in the following article, the first of a brief series, to consider the mode of origin of the common saline efflorescence of bricks. A series of researches which I conducted at the *Laboratory for Clay Industries* of Professor Seeger and E. Cramer, of Berlin, Germany, and which were continued in practical work in America, furnished me with results that not only afford a clear explanation of the origin of efflorescence, but also point to the practical means of avoiding the same. The means of avoidance I shall discuss in a separate article.

By "efflorescence" I understand what is commonly termed "whitewash," wherever and whenever such incrustations appear. For the sake of clearness I shall follow the process of brickmaking in all its successive single stages, as commonly conducted, and point out at each step the causes concerned in the production of the chemical salts occasioning the annoying superficial colorations in question.

Most noticeable and most annoying are the *white* efflorescences on red or yellow brick; less striking are the green and yellow incrustations on light brick. The white efflorescences are always of inorganic or mineral origin, being mainly sulphates of lime, magnesia, and alkalies. We shall consider here the formation of the white efflorescences, reserving the green and yellow for another occasion, and as a matter of clearness distinguish carefully between: —

1. The formation of efflorescent sulphates which are found *already formed* in the clay pits, or which are first formed from *allowing the clay to lie unused* for a certain length of time, or which arise at any time *during the making of the clay* into green bricks; and

2. The formation of sulphates which arise during the water-smoking and during the burning of the green material in the kilns.

This distinction is necessary, because practical brickmakers are prone to think that water-smoking alone is the cause of the whitewashing sulphates making their appearance on the finished products.

I.

ON THE FORMATION OF THE EFFLORESCENT SULPHATES IN THE CLAY BEDS, ETC.

The majority of clays used in brick and terra-cotta making contain greater or less quantities of mineral salts. Chemical analysis has shown that these salts are sulphates of lime and magnesia, less frequently of iron and alkalies. These sulphates are formed by the weathering of finely and uniformly distributed particles of iron pyrites, which is an almost constant accompaniment of the clay. Through the action of water, air, and heat the iron pyrites (FeS_2) is gradually oxidized and converted into ferrous sulphate ($FeSO_4$), which, being easily soluble in water, is, in union with the carbonates of lime, magnesia, and alkalies, whose constant presence can also be shown, converted into the respective sulphates of these combinations. For example, $FeO.\ SO_3 + CaO.\ CO_2 = FeO.\ CO_2 + CaO.\ SO_3$.

It is readily intelligible now that the more minute the distribution of the iron pyrites is in the clay, and the more the mass as a whole is exposed to the influences of the weather, *i. e.*, to the effects of water, air, and heat, the greater the quantities of iron pyrites oxidized and the greater the quantities of soluble sulphates stored up in the clays. If we are using, for instance, a stony clay belonging to the carboniferous formations, which always contain heavy quantities of iron pyrites (*e. g.*, blue shale), and work the same into green bricks immediately, and at the beds where the clay is found, then certainly the whitewashing is far less apt to be noticeable than if the

clay had been suffered to lie for months before using, exposed and in the open air.

To prove this, I analyzed several specimens of clay from the same pit, and so determined the amount of soluble sulphates in each. One specimen was taken from the upper layer of the clay, another from a lower layer quite protected from the air and heat. The analysis showed that the upper layer contained four times as much soluble sulphates as the lower, protected layer.

Another experiment yielded similar results. I took *three* specimens from the *same* layer of clay. Of the first specimen, 100 grams were *immediately* analyzed and the amount of sulphates therein contained determined; of the second specimen, 100 grams were finely pulverized, moistened, and exposed to the weather for three months, and at the expiration of that time analyzed for the amount of sulphates; while 100 grams of the third specimen were likewise finely pulverized and let lie for three months in a dry, hermetically sealed tin box and then analyzed. It turned out that specimens 1 and 3 contained almost equal amounts of sulphates, while specimen 2 showed six times the amount of the others. Another clay, likewise belonging to the carboniferous period, having been let lie for months in the open air, left behind it on the ground where it had been heaped large quantities of beautifully formed gypsum crystals.

But even if such clays are worked into bricks immediately upon being transported from the pits, it does not necessarily follow that the formation of sulphates will be entirely prevented. If the green bricks be let stand a long while in the drying rooms a constant oxidation of the iron pyrites will take place on the surface of the bricks through the action of the moist atmosphere, and, concomitantly with this, the formation of sulphates which, while not visible to the eye in the green bricks, will, after burning, make their appearance in the shape of whitewash. To prevent this, not only is the immediate working of the clay into green bricks necessary, but it is also requisite to dry and to burn the bricks with all the expedition possible.

The oxidation of iron pyrites is accordingly a main cause of the formation of sulphates occasioning whitewash. A second source is the sulphur contained in the water employed in the preparation of the clay. This water frequently contains gypsum; and since many clays require so much as 30 per cent. of water for rendering them plastic, the gypsum present in the water naturally contributes a high quota to the formation of the annoying superficial efflorescences in question. So, too, by various other admixtures, as mineral colorings, oxide of iron, ochre, superoxide of manganese, the whitish efflorescences can be augmented. Wherefore, it is necessary that all such substances when used as admixtures should, without exception, be analyzed for the amount of sulphates they contain.

The quantity of water requisite for working the clay depends wholly on the nature of the clay and on the peculiar methods employed in working it. The greater the quantity of water, the greater the quantity of the sulphates dissolved in it, and the greater the quantity of dissolved salts deposited on the surface of the bricks in drying.

The method of drying is also of paramount importance, both as bearing on the formation of these efflorescences and as affecting their visibility on the surface. The quicker the drying can be perfected, the more advantageous will be the appearance of the burnt product, for in a perfectly dry brick all further oxidation of the iron pyrites is absolutely excluded; and then again, in consequence of the rapid evaporation of the water, the dissolved sulphates are not wholly deposited on the surface of the product, but in large part are left behind in the pores of the clay. The drying process consequently deserves the highest attention at the hands of the practical brickmaker. But since the space at my present disposal is limited, I shall reserve the discussion of the advantages and disadvantages of the different methods of drying for a future occasion.

To recapitulate: the substances giving rise to the efflorescence or whitewash of green clay products are (1) the soluble sulphates contained in the natural clays, and (2) the sulphates formed during the storing and initial treatment of the clays consequent upon the weathering of the iron pyrites and its resultant transformation into sulphuric bases. It remains to be mentioned that the efflorescences which find noticeable lodgment upon the green, unbaked material are subsequently burnt in indelibly on the surface of the brick, and can be removed neither by chemical nor mechanical means.

II.

ON THE FORMATION OF SULPHATES WHICH ARISE DURING THE WATER-SMOKING AND DURING THE BURNING OF THE GREEN MATERIAL IN THE KILNS.

The presence of iron pyrites in the clay is, we have seen, the main cause of the origin of whitewashing sulphates on the surface of the unburnt material, and iron pyrites again is chiefly concerned in the production of whitewashing sulphates during the water-smoking and burning of the green products. This happens in a twofold manner — first, and again, by the presence of iron pyrites in the clay; and secondly, and particularly, by the iron pyrites contained in the coal, which is mostly used as a fuel.

In burning two processes are distinguished: (1) water-smoking, and (2) burning proper.

WATER-SMOKING.

The object of the water-smoking is to expel the water which has been mechanically absorbed by the clay, and which still remains in it after drying,— the so-called "hygroscopic" water,— whereby the clay is thoroughly dried, but loses none of its original physical qualities. The purpose of burning, on the other hand, is (1) the expulsion of the water *chemically* contained in the clay (clay substance being essentially $Al_2O_3(SiO_2)+2H_2O$, (2) the chemical disintegration of the several components of the clay, and (3) a more or less perfect fusion of the individual argillaceous particles, whereby a definitive and permanent alteration of the substance is attained. With the loss of the chemically contained water, the clay loses its plasticity — a property so essential to the manufacture of argillaceous products.

We shall consider the process of water-smoking first, which has for its object the expulsion of the hygroscopic water. Since water is converted into steam at 212 degs. Fahr., this latter is the proper temperature for the process — attainable only by the artificial convection of heat to the products, *i. e.*, by the consumption of fuel. But since the size and the construction of the kiln in which the water-smoking is conducted renders it absolutely impossible for a perfectly uniform temperature to be obtained throughout the whole enclosed space, consequently that portion of the kiln and of the contents of the kiln which first comes in contact with the hot gases from the fireplace will be heated first. At these points a part of the water in the green products will be converted into steam, whilst at points more remote from the fireplace scarcely any rise at all in temperature will be noticeable. At these latter points the water vapor originating at the first points will be condensed and precipitated on the surface of the cold green products, whence, since the clay is strongly hygroscopic, it will be absorbed into the interior of the bricks. If the clay, now, still contains soluble sulphates in its interior, these sulphates will be dissolved in the water, and later, when the points in question have in their turn reached evaporating heat, will be drawn to the surface of the bricks, and, as the heat is increased, be burnt in there. If the green clay does not contain sulphates, or if the sulphates be rendered innocuous by the admixture of appropriate chemicals, the water so condensed will have no injurious effect upon the appearance of the bricks, provided the fuel employed contains no sulphur. But if a sulphurous fuel be employed,— for example, coal, which always contains more or less iron pyrites,—the water will absorb the gases of the sulphurous acids produced by the combustion of the iron pyrites, and this diluted acidic solution will act on the carbonates in the clay and form sulphurous salts, which, as the heat increases, will come to the surface and there be oxidized to sulphuric salts, thus causing again the annoying colorations.

(*Continued.*)

Fire-proofing.

HOW TO BUILD FIRE-PROOF.

BY FRANCIS C. MOORE,

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Delegate of New York Board of Fire Underwriters to the Board of Examiners of the New York Building Department.

BY way of preface to the following article, I wish to say that it has been prepared after careful consultation with well-known experts, and after careful observation and study of numerous fires in this class of structures, and especially in those which caused losses to my own company.

I think it advisable, in an article of this kind, to state, as premises, certain propositions which might be treated as deductions. Some of them are axiomatic or self-evident, needing no demonstration, and ought to appeal to any practical mind as being truths, rather illustrated than demonstrated by the experience of the past few years. In accordance with this line of treatment, I desire to state by way of premise: —

First. It may be claimed that no construction is fire-proof, and that even iron and masonry could with propriety be designated as "slow burning." The iron or steel used in a modern building has, in its time, been smelted in a furnace which presented no greater capacity for running metal into pigs than some of our modern buildings, whose interior openings from cellar to roof correspond to the chimney of a furnace, and the front door to its tuyere. If a pyrometer could be adjusted during the progress of a fire it would be found to rise quite as high as in any forge.

Second. Glass windows will not prevent the entrance of flame or heat from a fire in an exposing building. It may seem strange that so obvious a proposition should be thought worth stating, and yet to-day more than 75 per cent. of the "fire-proof" structures of the country have window openings to the extent of from 30 per cent. to 70 per cent. of the superficial area of each enclosing wall without fire-proof shutters. Heat from a building across a wide street finds ready entrance through windows, and the several fire-proof floors serve only to hold ignitable merchandise in the most favorable form of distribution for ignition and combustion like a great gridiron to the full force of a neighboring fire. This was the case in the burning of the Manhattan Bank Building, on Broadway, in New York, and of the Horne Building, in Pittsburgh. The latter building was full of plate glass windows, 16 by 16 ft. Such buildings are not more capable of protecting their contents than a glass show-case would be. A recent article on the Pittsburgh fire in the *Engineering News* aptly expresses this in the following words: "There seems to be some irony in calling buildings fire-proof which opposed hardly anything to a fire from across the street more sturdy than plate glass!"

Third. Openings through floors for stairways or elevators, gas, water, steam pipes, and electric wires, from floor to floor of fire-proof buildings tend to the spread of flame like so many flues and should be fire-stopped at each story. This fault is more generally overlooked than any other. Ducts for piping, wiring, etc., should never be of wood, In the Mills Building, in New York, a fire, not long since, jumped through two or three floors from the one on which it originated, by means of the passageways for piping, electric wiring, etc., comparatively small ducts, but sufficient for the spread of flame. In one instance the fire skipped one floor, where it was cut off, and ignited the second floor above.

FIRE-PROOFING IRON MEMBERS.

Fourth. In view of the fact that it is necessary to cover iron with non-combustible, non-conducting material to prevent its exposure to fire and consequent expansion, and in view of the fact that all ironwork, except cast iron, will rust to the point of danger, it is best to use cast iron for all vertical supports, columns, pillars, etc. It is not advisable, of course, to have floor beams of cast iron (except in the form of Hodgkinson beams thoroughly tested). If a floor beam should give way, however, it might not necessarily wreck the building, whereas if a vital column should give way a collapse of the entire structure might result.

RUST.

At a convention held some years ago in New York, at which were present a greater number of experts in iron than probably ever met before or since in one room, there was not one who contended that cast iron would rust beyond the harmless incrustation of the thickness of a knife blade, whereas there was not one who did not believe wrought iron would rust to the point of danger; and there was not one who claimed to know whether steel would or not, each admitting that steel had not been sufficiently tested as to rust to warrant a reliable opinion. If it could be relied upon as rust proof, it would be superior to all other material for fire-proof buildings because of its great strength in proportion to weight. The use of steel in construction is growing, because it is cheaper than wrought iron, as lighter weights are used for the same strength, but while supposed to be superior to wrought iron, some of the prevailing impressions with regard to it are erroneous. Defects not possible of detection by tests are liable to exist in its structure. Among the first steel beams brought to the city of New York there were instances in which they were actually broken in two by falling from the level of trucks to the pavement, probably due to their having been rolled when too cold, as steel when rolled below a certain temperature becomes brittle. Better beams are now made.

In my opinion, cast-iron columns are superior to steel and more reliable. It is not generally known that American cast iron is vastly superior to English cast iron, and will stand a greater strain without breaking. Cast iron, moreover, will not expand under heat to the same extent as wrought iron and steel, which is another fact in its favor.

COLUMNS SHOULD BE STRIPPED.

No bearing column should be placed in such a position that it cannot be uncovered and exposed for examination without danger to the structure. One of the ablest architects in New York makes it a rule to so fire-proof his columns that they can be examined at any time by removing the fire-proofing to determine whether rust has invaded their capacity to carry their loads. In my judgment, periodical examinations should be made, from time to time, in this way of all wrought-iron or steel columns, as it may happen that a leaky steam or water pipe has worked serious harm. Such a discovery was accidentally made recently in an important New York building.

CEMENT AS A PREVENTIVE OF RUST.

Numerous newspaper paragraphs appear, from time to time, which claim that metal stripped of its covering of cement has been found exempt from rust, with the paint intact, etc., and the fact is cited as evidence that cement is a preservative of iron and that the danger of rust is over-estimated. It is probable that cement will protect paint for a long time, and, of course, paint, if properly put on, will protect iron while the oil in it lasts. Painting, by the way, should be done with the best quality of linseed oil and without the use of turpentine, benzine, or dryers. It should be thoroughly applied in three coats, with about a gallon to 400 sq. ft., and the iron should be first thoroughly cleaned of rust and dirt, by pickling or other process. Paint is rarely properly applied, however, and even when of the best quality, is a preservative of the metal, as already stated, only so long as the oil in it lasts.

Those who claim to have evidence of the exemption of iron from rust rely, I think it will be found, upon iron which has been under exceptionally favorable conditions, free from dampness, the action of gases, etc., overlooking the fact that a leaking water pipe or steam pipe, or the escape of gases from boiler furnaces, will attack iron and gradually but surely consume it. A notable instance of this is the case of the plate girder of the Washington Bridge over the Boston & Albany Railroad, in Boston, where a quarter-inch plate girder was recently found to be entirely consumed in places from the operation of gases from the locomotives passing below.

It is quite common to have advocates of wrought iron cite railroad bridges and the elevated railroad structures of New York as proof of their claims, but if they will take the trouble to examine these structures they will discover that in spite of the fact that they are exposed to view, so that they can be painted frequently, the evidences of rust are unmistakable, especially about the rivets; and one can well imagine what would be the result in the case of riveted iron members in the skeleton structure of a building where such ironwork is entirely concealed from view, periodical inspections being impossible.

Rust is especially liable in the cellars and basements of buildings. The wrought-iron friction brakes of freight elevators in the cellars of stores, for example, are frequently found so consumed with rust as to be easily rubbed to pieces in the hand.

Steel rivets are dangerous and they should never be used, unless of a very superior quality, so soft that hammering will not crystallize the material, and yet with sufficient tensile strength to insure perfect holding qualities. This is difficult to secure. Their use in columns for buildings is objectionable, as they rust badly under certain conditions; columns, therefore, should be without rivets, and the beam-bearing bracket shelf on cast-iron columns should be cast in one piece with the column.*

EXPANSION OF IRON.

It is generally supposed and frequently stated that there is a great difference between the expansion of iron and masonry by heat. This is not the case. For example, the length of a bar which at 32 degs. is represented by 1, at 212 degs. would be represented as follows: —

Cast Iron	1.0011
Wrought Iron	1.0012
Cement	1.0014
Granite	1.0007
Marble	1.0011
Sandstone	1.0017
Brick	1.0005½
Fire-brick	1.0005

In the fire-proof building of the Western Union Telegraph Company, in New York, some years ago, a heavy brick pier, 7 or 8 ft. in diameter, adjoined the wall of the boiler furnaces. The difference in expansion in the brickwork next to this furnace wall as compared with that of the remaining brickwork of the pier was so great as to produce a crushing of the material from top to bottom of the pier for a depth of several inches, and it was found necessary to change the furnace wall and leave an air space between it and the pier.

EXPANSION.

While the difference in expansion between masonry and iron incorporated with it is less per running foot than is generally supposed, and while the difference in expansion between a cubic foot of iron and that of a cubic foot of masonry would hardly be noticeable, especially if the iron were covered on all four sides, yet in stretches of 50 ft. or more, as in the case of iron I-beams and girders, the cumulative effect of expansion in uncovered iron might be a serious matter — quite sufficient with the rises of temperature due to a burning building to push out the bearing walls and wreck the building. Especially is this true of temperatures higher than 500 degs. It is unnecessary to suggest that metal differs from masonry in the important respect that heat does not travel throughout the entire length of the latter, while it does in the case of metal.

In other words, while the difference between the expansion of a lineal foot of iron as compared with a lineal foot of masonry, marble, brick, etc., is very slight, the difference in conductivity is very great. The conducting power of silver, for example, being represented by 1, copper would be .845, cast iron .359, gold .981, marble .024, and brick .01 — an important fact to be considered in the construction of buildings. Brickwork raised to a white heat would not raise the temperature of other masonry in the same wall a few feet away, but one end of an iron I-beam could not be raised to a white heat without raising the temperature of the beam for its entire length.

It is a well-known fact that iron responds so readily to temperature that, in surveying land, a surveyor's 100 ft. iron chain will, in measuring the distance of a mile, result in a variation of 5 ft. between winter temperature and summer temperature, resulting in an error of one acre in every 533.

Where iron beams and girders are inserted in walls without sufficient space left for their expansion under heat they are almost certain to overthrow the bearing walls by their expansion thrust. A large warehouse in Vienna in which such provision had been contemplated by the architect was totally destroyed, with its contents, by reason of the fact that an officious subordinate, discovering the space in the wall purposely left at the end of each beam, deliberately poured liquid cement therein, which, having set, effectually thwarted the well-meant intention of the architect, and resulted in the destruction of the building.

The expansion thrust of iron beams may be computed upon the following factor of expansion: Rolled iron of a length of 1,562 ft. will expand one eighth of an inch for every degree of temperature. The heat of a burning building as already stated is enormous — sufficient to fuse most known materials; it may safely be estimated to be at least 1,000 degs.; therefore a length of rolled iron of 1,562 ft. at 1,000 degs. of temperature would expand about 125 ins., and a 50 ft. length of iron girder would expand between 4 and 5 ins., showing that there should be a play at each end of at least 2 ins. if the iron is not fire-proofed. Inasmuch as in iron construction the iron beams and girders are usually anchored to the walls to steady them, the space should be left and the tie to the anchor should be by a movable hinge joint, which would be of the same strength with an inflexible anchor for all tying purposes, but would yield under the thrust pressure like an elbow and allow play of the beam, or stiff anchors should have elongated holes to allow expansion when beams are of great length. Girders are seldom over 25 ft. long, but if bolted together, as is frequently the case, they may be 120 ft. or more long, and a line of columns from cellar to roof of a building may easily have one continuous iron structure of two hundred or more feet. It should be remembered, however, that this danger from the expansion of iron may be almost wholly counteracted by protecting it from exposure to fire through the use of non-conducting material. It is more important to protect girders than beams.

The mistaken pride with which the owners of some buildings point to exposed iron beams in ceilings as evidence that the floors are "fire-proof," actually justifying the supposition that they are left exposed for such display, would be ludicrous if it were not serious. In buildings occupied for offices or dwellings, where there is not sufficient combustible material to endanger the beams, it is not so objectionable; but in warehouses and stores, filled with merchandise, such construction is dangerous; and if one of the upper floors should give way it would come hammering down to carry all below and thoroughly wreck the structure.

In this connection it is well to say that combustible merchandise should never be stored 100 ft. above the street grade even in a fire-proof building, since the average fire department cannot reach it at that height.

ROOF.

Fifth. The roof, that portion of a building which ought to be most carefully watched during construction, is often the most neglected, woodwork entering into the composition, as in the case of the Horne Building, at Pittsburgh, where the cornice was supported on wooden outriggers.

Sixth. Partitions. These should not be erected upon wooden sills, as is sometimes the case — only, however, with ignorant and inexperienced architects, who suppose that it is necessary to use wood in order to nail baseboards and other trim at the bottom of the partition. Porous terra-cotta will hold nails and should be used in preference to wood, which, as soon as it burns out, will let down the entire partition.

WATER STANDPIPES.

Seventh. All buildings over 125 ft. high should be provided with 4 in., or, better still, 6 in. vertical pipes, with Siamese connections at the street, for the use of the fire department, extending to the roof, with hydrants at each story and on the roof. This would save the time of carrying hose to upper floors — a difficult task in the case of high buildings. Ample tanks of water should be provided on the roof supported by protected iron beams resting on iron templates on the brick walls, to supply the building's inside pipe system for fire extinction, and secure pressure by gravity or by some other method constantly operative, especially on holidays and at night. Stone templates should not be used, and care should be taken to secure strong supports so that, in the event of fire below, the tanks will not come crashing through the building to destroy it and endanger the lives of firemen. Two such disasters in fire-proof buildings within a year show how true is this proposition. Tanks in the basement under air pressure are also a great advantage, and recent invention has perfected them to the point of reliability.

Fire Marshal Swenie, of Chicago, urges that standpipes should not be less than 6 ins. internal diameter, and that a check valve should be provided, so that when steamers are attached their force will be added to that of the local pumps. Each floor should have hose connections with the standpipes and sufficient hose to reach to the most remote point of the floor above, and this hose should be frequently inspected to see that it is in order. He recommends that a code of signals by which communication can be established between the firemen and the engineer of the building is essential.

NIGHT WATCHMAN.

Eighth. All high buildings should have constantly present, night and day, some competent person understanding the elevator machinery, fire appliances, etc., so as to aid the firemen in reaching the upper levels; and there should be sufficient steam in the boilers, at all times, to run one elevator.

I quote from the valuable treatise on handling fires in these buildings presented by Fire Marshal Swenie to the International Association of Fire Engineers held in August, 1897. He says: —

"In case the elevators fail it is necessary to use the stairway, and after the truck men should follow the pipe men bearing the necessary hose, and this must be carried on the shoulders of the men. A 50 ft. section of ordinary 2½ in. cotton hose with couplings weighs from 56 to 60 lbs., and 250 ft. of 1¼ in. rope about 65 lbs., either of which is a good load for a man who must climb a steep stairway to the height of 250 ft. With an average rise of 7 ins. per step, that means taking some 430 vertical steps before reaching the scene of action and consuming from 7 to 10 minutes of time. If it is found necessary to use hose instead of the standpipes for taking the water from the street to the floor, the hose should be taken up in the elevator, if it is running, and then lowered until connection is made with the hose below."

STONE STAIRCASE TREADS.

Ninth. Marble, slate, and other stones are certain to disintegrate or crumble when subjected to the joint action of heat and water. For this reason 90 per cent. of the staircases in modern fire-proof buildings would be found utterly unreliable in the event of fire, either for the escape of the inmates or for the use of firemen — a serious consideration. Stone treads are usually let into iron rabbet frames, and as these stone treads would give way in case of fire, it would be impossible for a person to find a footing on the stairways; 2 in. oak treads might actually last longer; but a safer staircase would be one the framework of which is of iron, the tread having an iron web or gridiron pattern, the interstices or openings of which should be small enough to prevent the passage of a foot, underlying the stone or slate, so that if the stone tread should disintegrate the staircase would still remain passable.

It is possible to have the supporting tread of open-work cast iron in an ornamental pattern, which in relief against the white marble tread resting on it would present a tasteful appearance from the underside or soffit of the staircase, with this great advantage that, in the event the action of fire and water should pulverize the marble or slate tread, it would still afford a safe support for the foot. In the case of the burning of the two fire-proof buildings, Temple Court and the Manhattan Savings Bank, in New York, the slate treads yielded early in the fire, leaving staircases with openings the full size of the tread, which, within a few minutes after the fire started, were impassable for either firemen or inmates. It is astounding that this vital fault should be so generally overlooked in fire-proof buildings.

I may here state that the Manhattan Savings Bank Building did not deserve to be called "fire-proof" for the reason that it had hollow spaces under the wooden floor boards, and that the iron beams and girders were not protected. Some of them were large riveted box girders, which yielded quickly to the heat of burning goods and pushed out the side walls.

It is generally supposed that it is not necessary to be careful as to stone treads in buildings occupied solely for offices separated in fire-proof hallways in which, it is claimed, there is nothing to burn; but in the case of one large fire-proof building of this kind in New York I found the space under the staircase in the basement story was used to store the waste paper and rubbish of the building — material particularly likely to cause a fire by concealed matches, oily waste, cigar or cigarette stumps, etc., and to make a lively and quick fire quite sufficient to destroy stone staircase treads. Even where there is no combustible material in the hallway, if the staircase is near windows stone treads may be destroyed by exposure to burning buildings and by the combustion of window frames, dadoes, and other wooden trim.

Tenth. No building should exceed in height the width of the street on which it is located, from the view point of light and health; nor in any case, in excess of 95 ft. for mercantile occupancy, nor a height in excess of 200 ft. for office occupancy.

DESTRUCTIBILITY OF CONTENTS.

Eleventh. It should be remembered that merchandise, furniture, etc., are combustible, no matter whether located in fire-proof buildings or in ordinary buildings. This obvious fact seems generally to be ignored. In fact, combustible material will sometimes be more effectually and thoroughly destroyed in a fire-proof building than in an ordinary building, since the early collapse of the latter may smother the fire and effect salvage, whereas fire-proof floors support the contents of the former and distribute them so that they are more certain to be destroyed. There was not a dollar of salvage in the great stock of merchandise in the Horne Building, at Pittsburgh. The entire household furniture of a tenant in one of the best fire-proof apartment houses in New York was totally cremated, and a fire in the Great Northern "fire-proof" Hotel, at Chicago, seriously burned the automatic organ to the extent of over $4,000. There is no more reason why the combustible contents of a fire-proof building should not be consumed than why the fuel in a stove should not be burned.

Twelfth. Enclosing walls. These should be of brick, the brickwork of the lower stories especially, if not of all, being laid in cement mortar. In fact, the specifications for a building in the compact part of the mercantile section of a city ought to be drawn in contemplation of the possible cremation of its contents and the generation of heat considerably greater than 2,000 degs. Fahr. The heat of a wood fire is from 800 to 1,140 degs.; charcoal, about 2,200 degs.; coal, about 2,400 degs. Cast iron will melt at between 1,900 and 2,800 degs.; wrought iron, 3,000 to 3,500 degs.; steel, 2,400 to 2,600 degs.; and if an architect should be required to draw specifications for a building adjoining others, with the knowledge beforehand that its entire contents, from cellar to roof, were to be totally consumed, and he were under a bond to pay damages to surrounding property, he would not be more severe in his exactions than should a building law protecting neighborhood rights in the enjoyment of property; for a mercantile or manufacturing building sometimes generates a greater heat in combustion than a smelting furnace.

The Masons' Department.

AN EXPERIMENT IN MUNICIPAL WORK.

PROMINENT among the many details of municipal government which must be worked out to a satisfactory conclusion by practical experience is that of the method of awarding contracts for public work. At the present time the law usually provides that all such work amounting to over a certain sum, usually from one to five thousand dollars, must be open to public competition. It has been supposed, until recently, that the most serious objection to this method of procedure was the fact that it resulted in a majority of cases in the awarding of the work to some second or third rate contractor who produced only ordinary or inferior work. But the mayor of one of our largest cities, after having tried to enforce his interpretation of the stipulation in a city building contract providing that "preference shall be given to union labor" (which his honor maintained, until the court rendered an adverse decision, was practically mandatory), has decided that the proper way to construct municipal buildings is to have the work done by union men and by the day. Of course, in order to try such an experiment, the existing laws requiring an open competition and the award to the lowest bidder must be repealed.

This change the master builders have opposed, probably as a matter of principle; but it is a question whether it would not be better in the end to permit the experiment to be made. The present methods are acknowledged to be bad, and certainly the only way to improve such conditions is to try other methods. But while it may on the whole appear desirable to know the result of having a public building built by the day by union labor, there are two serious difficulties which must be overcome before such a system can be successful.

The great objection to day labor on large and important works is, primarily, the fact that the men employed under such conditions have not the incentive to work to the best of their ability, and it is unquestionably a fact that the same gang of men on a contract job would do much more work in a given time than where the work was being paid for by day labor. The reason for this is so obvious that explanation is unnecessary. As things are at the present time, if a city building is built by day work, the length of time necessary for its construction and the bill for labor will probably present an interesting and at the same time an extravagant comparison with similar work done under the direction of an able contractor and his foremen.

The other reason why work done entirely by members of the various unions is likely to prove unsatisfactory is that up to the present time the unions have done but little to improve the quality of work, and this fact is responsible for one of their greatest weaknesses. Although this statement would probably be emphatically denied by union members or sympathizers, the fact remains that to-day most of the best mechanics either do not belong to the union at all, or else are indifferent and passive members.

The unions are now controlled and managed by a class of men who are better talkers than workers, but as soon as the skilled mechanics become enough interested in the union of their particular trade to control its policy and make its membership a guarantee, so far as possible, of the ability of its individuals, both as to ability to do work well and the capacity to do it quickly, then, and not until then, will the labor union feel the support of public opinion, which is absolutely necessary for its successful existence. But although these objections to the plan of having a municipal building built by day labor have been pointed out, and the opinion expressed that the result will be disappointing, nevertheless, let us by all means try the experiment, and very likely valuable lessons will be the consequence. Certainly in any, if not in a majority of cases, the best way to show the fallacy of socialistic schemes is to give them a full and fair trial.

THE ethics of trade are extremely nebulous in the minds of a great many persons. A feeling is often manifested that, considering the keen, sharp competition to-day, and the fact that the supply of work is so far below the desires and demands of the craftsman, the only motto to be considered is the one which has been popularly ascribed to one of our political bosses, "Do others as they would do you." Fortunately there is a saving remnant of those who do not ascribe to such doctrines, but make it their principle to be fair with those with whom they have dealings. The building trades, with their wide subdivision of interests and complexity of departments, offer a large opportunity for a contractor to take advantage of his fellows, especially in his relations with sub-contractors, and we wish to emphasize one evil which is only too prevalent, namely, the trading on sub-bids. A general contractor will make up a figure to be submitted in competition, and will use sub-bids for portions of the work, incorporating them in his own; and then if the contract is awarded him, in only too many cases does he deliberately ignore the sub-bidder over whose shoulders he has stepped to a contract, and, on the principle that he has a right to purchase his wares where he can get them cheapest, will proceed to make new deals with mechanics, and use his earlier bids as clubs to beat down the price. This is all wrong; it leads to demoralization of building interests, it encourages and almost obliges inferior work, and it is a practise which cannot be too severely condemned. The present system of contracting, where everything is awarded to one responsible head, has many advantages, but there ought in principle, as well as in fact, to be the most scrupulous regard for good faith between the general contractor and the sub-bidders, if we are to have the uniformity in the quality of the work which every one desires. Once a bid has been passed in and used it ought to be adhered to, and the sub-contractor whose bid is so used is entitled in equity to the contract.

Another feature which is often not properly regarded is the changing of a bid after it has been once made. There are plenty of owners who will endeavor to take advantage of a tight market, hard times, or scarcity of work, and will make a builder an offer of considerably less than his bid. We are sorry to say that some architects will lend themselves to this practise by endeavoring to please the owner, and will aid in beating down a contractor. We know of one architectural firm, however, doing a very large business, which has made it a rule, which is adhered to pretty thoroughly, never to allow a contractor to change a bid either up or down after it is once put in; and if after a bid has been made in good faith a builder cuts his price, that builder is very apt to find himself dropped out next time bids are called for. The result is that this firm gets bottom prices first time, as no bids are made with the idea of their subsequently being shaved off a bit. This is quite as it should be. We believe in fair and even liberal profits to all mechanics; but if a bid is respected as it should be, the bidding will be closer to start with, and there will be a feeling of honorable treatment between the owner and the contractor which will go far towards securing better work. The same applies exactly to bids between contractors and sub-bidders; and while work might be wanted so badly that the tendency would be to cut the price rather than lose the job, if it were a more general custom to insist upon adherence to the original bid, and the contractors knew they would be fairly treated in the matter, it is probable that every one would be better satisfied.

LIQUIDATED DAMAGES FOR BREACH OF CONTRACT.

A PROVISION in a contract for the construction of a residence that the builder, in case of non-completion of the house by a given date, should pay ten dollars for each day's delay, is a stipulation for liquidated damages. The failure of a subcontractor to fulfil his contract is no defense to the recovery of such damages. And where a builder agrees to construct a building by a certain date, which requires that it shall be done during winter months, the severity of the winter alone is insufficient as an excuse for failure to perform, if the work could have been carried on by the exercise of extra means or effort.—*Supreme Court, Washington.*

Brick and Terra-Cotta Work In American Cities, and Manufacturers' Department.

NEW YORK. — We have just entered upon the third month of our existence as Greater New York, and in view of the criticisms now being passed upon the "machine" administration, it is interesting to recall some of the public benefits dispensed by the recent "reform" administration.

It must surely be a matter of pride to us when statistics prove that our summer death rate has not been so low in twenty-five years as during the season passed. This is a more significant fact than would at first appear to one not familiar with New York, with its great cosmopolitan population and its crowded streets and tenements; and the unusual and vigorous effort to keep these streets and districts clean has been a most important factor in the saving of life, for which great credit is due to Col. Geo. E. Waring, upon whom the responsibility has rested. He organized and directed an army of men, dressed in appropriate uniforms, somewhat similar to the Parisian idea, and no expense or trouble was spared in having the work thoroughly done to the satisfaction of the public rather than the politicians.

Some of the worst slums on the East Side have been demolished and replaced by small parks.

Two recreation piers have been built and others are contemplated. These piers are two storied and are well patronized by those who are not fortunate enough to be able to take their families out of the city during "the heated term." Work has been commenced on the new North River Bridge, and land has been purchased for a second bridge over the East River, which will greatly facilitate communication between the various parts of the metropolis.

The post-office service has been greatly improved, the most recent innovation being the pneumatic tube mail carrier, which was tested last week and which proved eminently satisfactory.

The projected scheme of a tunnel connecting New York and New Jersey is being pushed, and we may confidently include this among the developments of the near future.

A great botanical garden is to be erected in Bronx Park, one of the most beautiful natural parks in the vicinity. This is a great work and will undoubtedly prove as popular as the gardens at Kew, England, which are visited by great numbers of people, sometimes hundreds of thousands in one day. The buildings will be laid out in such a manner as to carefully guard against destroying any of the natural beauty of the park. Over $500,000 will be expended. Drawings of some of these buildings will soon be reproduced in THE BRICKBUILDER.

RESIDENCES, NEW YORK CITY.
McKim, Mead & White, Architects.

It will undoubtedly interest architects to know that a company has been formed which has for its object the sanitary and structural inspection of buildings. It makes examinations and reports on the condition of buildings and premises for owners, tenants, and intending buyers, lessees or mortgagees, and supervises the construction, maintenance, and repairs of buildings, entering into yearly contracts for these services. The idea has met with considerable favor in the city. The names of several architects of high standing who are interested in the venture is a sufficient guarantee of the integrity of the association.

Most of the necessary money has been raised for the proposed monument to the late Richard Morris Hunt which is to be placed in Central Park. The expense of the work has been generously met by contributions from those who knew Mr. Hunt, and who admired his personality, his generosity, and devotion to his profession, and his sympathy and helpfulness to young men. He was one of the founders and one of the most enthusiastic members of the Municipal Art Society, which has for its object the protection of the city against promiscuous gifts of statuary, etc., which, if worthy, are one of the most beautiful adjuncts to landscape architecture, but if not, are an eternal blot. Although still young, the society is highly respected, and has accomplished great good. We can only hope for the time when works of architecture will be tried by some such fire. At present the press nobly seconds the work of censorship in regard to monuments, etc., and people are beginning to discriminate between good and bad work; but criticisms in regard to works of architecture, infinitely more important and more lasting, are cautiously whispered, and the work goes on so that now one of the largest and most important office buildings in New York is the most offensive, and caused a well-known editor to remark in private, "If that building had been designed by a younger man it would have ruined him." Among recent items of news may be mentioned: James Brown Lord, architect, has prepared plans for a new building, to cost $35,000, for the New York Circulating Library. It will be erected on 100th Street, near the Boulevard. Clarence True, architect, has plans drawn for twenty-four five-story brick and stone dwellings to be built on Riverside Drive; Edward Wenz, architect, has prepared plans for a five-story brick flat building on 101st Street, near Columbus Avenue to cost $45,000; Raleigh C. Gildersleeve, architect, has plans drawn for a five-story stone and brick dwelling to be erected on Fifth Avenue near 77th Street; cost, $75,000.

Brite & Bacon, architects, have planned a five-story dwelling, to cost $100,000, to be erected on the corner of Fifth Avenue and 64th

Street; Richard H. Hunt, architect, has completed drawings for the new east wing of the Metropolitan Museum of Art, which will cost $800,000.

PHILADELPHIA.— The workings of the law permitting the supervising architect of the Treasury to give out government buildings amongst architects for competition have just had a practical demonstration here, and given general satisfaction. Some eight Philadelphia architects were invited and submitted designs for a Custom House and Post-Office, to be built in Camden, N. J., in compliance with a strictly business-like program of competition describing in an explicit manner the number of and space required by the various departments, offices, etc. The cost stipulated was liberal without being lavish, the ground for the proposed building large enough to admit of light on all sides, so it may be seen how interesting was the problem, and how it required but an honest judgment and award to place the competition amongst the best. The decision of the experts, of whom there were three, including Supervising Architect Taylor, seems to indicate that, to the end, everything had been carried out satisfactorily. The successful architects, Rankin & Kellogg, are to be congratulated on this the latest of their many successes in professional competitions. Their design shows a dignified building in the style of the Italian Renaissance, having a two-storied-columned portico with pediment in center of façade, remainder having balustraded skyline. It is to be entirely of white marble. It seems perhaps still a great waste of architectural skill to have so many designs thought out with the certainty that only one can be used, but it is a step much in advance to have competition restricted.

TERRA-COTTA KEY.
Executed by the New Jersey Terra-Cotta Company.
Shickel & Ditmars, Architects.

The buildings of the University of Pennsylvania have a peculiar interest to the architect in the variety of their building material. The old-time green-stone University Hall stands side by side with the bright red press-brick and terra-cotta of the library, and seemingly shelters by its towering mass the low-lying Huston Hall with its English-mullioned windows in light stone set in the gray stone of Germantown. Across the way are some buildings in dull rough-red brick and red terra-cotta, while further out is the beginning of the dormitory system in a quaint red brick with bright Indiana limestone lavishly used. Standing at the lately finished Dental Hall, by Edgar V. Seeler, in its rich, warm colors, the walls of the museum close by just being put, in part, under roof, seem composed of yellowish-gray materials, but only a closer inspection shows how curious is the composition. Two rough, small-sized bricks are placed end to end, without mortar, so as to resemble one long brick, then a black or purplish header separated by about 1⅜ ins. of cement mortar. All the horizontal joints are of this thickness of cement. The scheme of the bond is after that known as Flemish, with stretchers double the usual length. These abnormally wide joints take almost as prominent a part in the general color effect as the red brick, with the result, as before mentioned, of giving the wall a very light tone.

The architecture is Italian, one might even say from Bologna, with round brick columns with the caps to be found there, while some beautiful patterns of colored marbles, eminently Bolognese, are set into the brickwork, in the tympanum of the windows, and in the friezes under eaves; also, curiously enough, between first-story windows under piers of the second story. A domed central structure is to dominate the mass, but of this only the foundations are in, — wide foundations of brickwork, looking now like the ruins of some Roman palace.

PANEL, SPINGLER BUILDING, NEW YORK CITY.
Executed by the Excelsior Terra-Cotta Company.
W. H. Hume & Son, Architects.

PITTSBURGH. — The increase in building operations expected with the beginning of the new year does not seem to have begun as yet; architects report considerable small work in progress, but practically no large office or mercantile buildings definitely decided upon.

Within the past year Pittsburgh has suffered severely from fires. The Horne fire of last summer undoubtedly caused the greatest financial loss, but the Pike Street fire of last month probably nearly equaled it in this respect, and was, in addition, accompanied by a terrible loss of life.

The burning of the building occupied by the Edmunson & Perrine Furniture Store, and of the Union Trust Company Office shortly followed the Horne fire, while a nine-story building on Penn Avenue,

RESIDENCE, BROOKLINE, MASS.
Winslow & Wetherell, Architects.

near 9th Street, was burned in the same week in which occurred the Pike Street fire.

Among competitions recently held but not yet decided have been those for the new Union Trust Company Building; for a new school building in Ward 20; for the First United Presbyterian Church to be erected on Fifth Avenue, near the entrance to Schenley Park; and for the City Deposit Bank, at the corner of Penn and Center Avenues.

The design of F. J. Osterling for the new Court House at Washington has been accepted; it is estimated to cost about $500,000.

Work has been commenced on the new ten-story apartment house on Forbes Street opposite Schenley Park. It is intended to have the building completed in time for use as a hotel during the triennial conclave of Knight Templars to be held here in October next; Rutan & Russell are the architects. This firm is also at work on a new armory building for the National Guard of Pennsylvania, to be located on Bedford Street.

Pittsburgh contractors are proving that they can erect buildings with as great rapidity as those of any city.

Work was commenced on the eight-story office building for J. G. Murtland, at the corner of Sixth Avenue and Smithfield Street, about the middle of November. It is to be ready for occupancy April 1. It is built of buff pressed brick, terra-cotta, and sandstone. The department store for H. C. Rowe, at North Highland and Penn Avenues, was begun at about the same date and is to be finished the same time. Alden & Harlow are the architects of both.

The new Horne Building is nearing completion. When the old building was burned the steel frame and most of the terra-cotta floor arches remained in place. After a careful examination and test they were found uninjured and it was decided to use them again. Peabody & Stearns are the architects of the present store. These architects have also recently let the contract for a new market house in the East End. It is 170 by 270 ft., is to be built of brick and terra-cotta, and cost $150,000.

TERRA-COTTA DETAIL, ST. CHRISTOPHER'S HOUSE, NEW YORK CITY.
Executed by the Conkling, Armstrong Terra-Cotta Company.
Barney & Chapman, Architects.

BUFFALO.— The new year has opened with a much more favorable outlook than has been in evidence for a long time. On every hand we hear that there is to be a much better season. Prices of building materials are raised, and the class of buildings seems to have been elevated.

The increased price of material will help to throw out a good many of the speculative builders, who have done so much to pull down domestic architecture to the level it is now on.

Buffalo property seems to be gaining in popularity amongst outside investors, as during the past few months large blocks of real estate have been sold to capitalists in New York and Pittsburgh. The new owners express their intention of building soon.

The Pan-American Exposition is making great progress. Contracts have been let for several of the main buildings. These structures, though possessed of some architectural pretensions, are designed for manufacturing purposes. The capital has been advanced by various large concerns, who, after the exposition is over, intend to take over the whole affair; and with the advantages of having electric power so close at hand, there seems to be no reasons why this should not become a great manufacturing center. All the power used at the exposition will be obtained from the Falls.

The largest piece of work in hand to be mentioned is the 74th Regiment Armory. As was mentioned in a former letter, bids had been opened for a stone building, but as the amount ran over $100,000 above the sum given by the State, the specifications were revised. Bids were asked for on various kinds of material, stone and brick, with the result that the building will be of Medina stone, at a cost of $335,585. It was proposed to build entirely of brick, but there was a general outcry against this, as it was thought that the appearance of the building would be spoiled.

It is said that the Iroquois Hotel is to be raised from eight to twelve stories, and that the banquet hall will be placed on the twelfth story, and is to be surrounded by other smaller ones so planned that, by an ingenious arrangement of the architect, Mr. Aug. Esenweim, they can be thrown into one large hall. The rotunda will be finished entirely in Mexican onyx and marble.

The city has had still another experience in letting contracts to the lowest bidder.

Two schools were commenced last year, both given to one man, he being on the second school nearly 27 per cent. less than the next highest. When the bids were before the school committee, representations were made that he had failed to carry out other contracts and that various material men had liens on the property. However, the contracts were given him, with the result that the buildings have been liened upon, and that the city will finish them. The Bond Company found loopholes to escape from fulfilling their bond, one being that the city finishes the work; and as that appears to be the next move, the men who have liens on the property will doubtless lose their money, as, the work being for the city, liens have no force for material, but only for money due. People are wondering why the Surety Company is not being made to finish the schools.

LAND LIABLE WHERE BUILDING HAS BEEN DESTROYED.

WHERE the laws of a State give a lien on the buildings or structures, and on the interests of the owner in the land on which they stand, for work done and material furnished and used in them, on destruction of the building by fire before completion the lien may be enforced against the land on which it stood. — *App. Ct., Ind.*

TRADE PUBLICATIONS.

WE have so often been asked to publish a list of American brands of cement and the particular class of work that each brand is suitable for, that we take pleasure in calling the attention of our readers to a group of pamphlets just issued by the Commercial Wood & Cement Company, Philadelphia and New York. These pamphlets, of which there are four, relate to the brands of American cement for which this concern is agent, namely, Commercial Portland, Commercial Rosendale, Victor Portland, and American Portland. Each pamphlet contains an amount of data and general information pertaining to the particular brand which it represents, that makes it not only interesting, but instructive and otherwise valuable. The more important work in which the cement has been used is enumerated, often illustrated, within these pages. In the pamphlet devoted to the interest of the American Portland brand there is published a most interesting paper by W. W. Maclay, C. E., on the "Testing and General Qualities of Portland Cement, and some Rules for Using It so as to Get the Best Results."

Copies of these pamphlets may be had by applying to the Commercial Wood & Cement Company, 156 Fifth Avenue, New York.

The Use of Terra-Cotta for Interiors.

WE have recently received a few samples of terra-cotta work from Fiske, Homes & Co., Boston, which we think deserve more than passing comment.

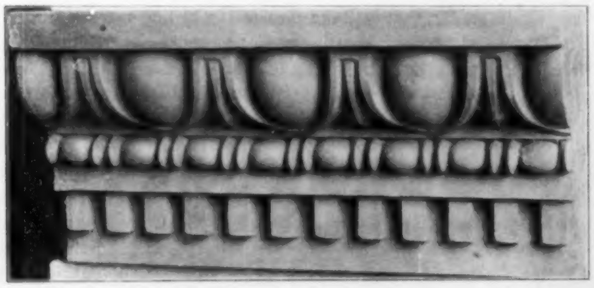
Terra-cotta for the exterior construction of buildings long ago took its place as one of the most desirable materials.

The construction and decoration of the interior of the modern home is, however, something of quite a different order, and requires a class of goods distinctly superior, in nicety of workmanship and careful selection of color, to those employed on the exterior.

In interior work, the structure is of comparatively small size, requiring ornamentation of low relief; the eye, being close to the work, is offended by the boldness and roughness which characterizes exterior designing, while jointing entirely suitable for exterior work appears crude when used on the interior.

Terra-cotta manufacturers have, as a rule, confined themselves to a grade of work suitable for exterior, and the architect and builder have, therefore, not found it desirable to use it extensively inside the building. Such a state of things is not necessary, *per se*, as the delicate product of the modern pottery bears evidence to the fact that burnt-clay products are capable of the finest workmanship.

Why a similar refinement should not be obtained in interior terra-cotta, thus combining the nicety of marble, *papier maché* ornamentation, or even woodwork, with the beautiful blending of colors obtainable only in clay products is a question which we cannot understand; and we believe, when the terra-cotta manufacturer realizes the fact that his work must take its place as a part of the interior furnishings of the room and produces work capable of such use, that it will be gladly accepted by the architect and builder.



The samples of interior terra-cotta illustrated herewith seem to us to be a decided step towards the realization of that perfection which we mention above. This work is produced for use about the fireplace, where bricks have been used from time immemorial, but where there has been a lack of proper clay products for ornamentation. The features which have prevented the universal adoption of brick mantels have been their crudeness of design and roughness of construction. Architects have been accustomed for years to overcome the former difficulty by making their own designs, but have experienced delays of manufacture, uncertainties of color, as well as great expense in the execution of this special work.

Could the architect feel sure of obtaining a good design, executed promptly from stock patterns, and with that certainty as to the nicety of workmanship and color demanded by interior conditions, it seems to us that clay products would be recognized as the most satisfactory in every way for fireplace construction.

These conditions seem to be realized by the work illustrated herewith to a remarkable degree. Not only are the designs good in arrangement and proportion of parts, but the modeling is done with special delicacy and refinement of lines not possible or even desirable for exterior work. The modeler seems to have kept before him the fact that the same perfection is demanded and should be realized in the fireplace as in the woodwork and *papier maché* ornamentation on the walls and ceilings, and even the furniture that stands around the fireplace. The edges are straight and true; the pieces are sufficiently uniform in color and size to enable the use of narrow joints and correct lines through the entire structure, thus largely obviating that crudity in appearance that has been characteristic of such work in the past.

All of the ornamentation of these mantels, where possible, is produced by terra-cotta rather than molded bricks.

Messrs. Fiske, Homes & Co. are well-known terra-cotta manufacturers of long experience, and they appear to have attacked the fireplace question as such rather than as brickmakers.

We believe they have contributed a valuable addition to the desirable materials for interior decoration and have given a new impetus to burnt clay on the inside of the modern house.

CURRENT ITEMS OF INTEREST.

R. GUASTAVINO Co. have removed their Boston office to 19 Milk Street, Room 53.

WALDO BROS. will supply Atlas Portland cement for draw pier, Charlestown Bridge, Boston; Perkins & White, contractors.

CHARLES TAYLOR'S SONS, Cincinnati, Ohio, manufacturers of enameled brick, fire brick, etc., are in the market for a clay disintegrator.

WHIDDEN & COMPANY have awarded the cement contract for foundation for new Boston Electric Light Company Plant to Waldo Bros., specifying Atlas cement.

JOHN W. HAHN, 166 Devonshire Street, has been appointed Boston agent for the American Enameled Brick and Tile Company, of New York.

WALDO BROS. will supply Atlas Portland cement to the Hartford Paving & Construction Company for government work at Fort Constitution, N. H.

THE POWHATAN CLAY MANUFACTURING COMPANY will sup-

TERRA-COTTA DETAIL, BRAZIER BUILDING, BOSTON.
Executed by the Northwestern Terra-Cotta Company.
Cass Gilbert, Architect.

ply 75,000 of their cream-white bricks for the new building which is to be erected at Richmond, Va., as a Home for Incurables.

THE Scollay Square station of the Boston Subway will be lined with enameled brick made by the American Enameled Brick and Tile Company, of New York; Norcross & Cleveland are the builders.

THE AMERICAN ENAMELED BRICK AND TILE COMPANY have closed a contract with Norcross Bros. for supplying the enameled brick that are to be used in the immense new Southern Terminal Station at Boston.

THE INDIANAPOLIS TERRA-COTTA COMPANY report a good spring business. They are now engaged on contracts for new work in Toledo and Cincinnati. The terra-cotta for the Edison Electric Light Company's new building in the latter-named city will be furnished by them.

THE BRICK TERRA-COTTA AND SUPPLY COMPANY, Corning,

TERRA-COTTA DETAIL, BLIND ASYLUM, OVERBROOK, PA.
Executed by the Burlington Architectural Terra-Cotta Company.
Cope & Stewardson, Architects.

N. Y., are furnishing the architectural terra-cotta required for the Fourteenth Ward School building, Syracuse, N. Y., M. D. Makepiece, architect.

THE BRISTOL AND PLAINVILLE TRAMWAY COMPANY are erecting near Plainville, Conn., a new substantial steel bridge, having a span of about 90 ft. The bridge has been designed with a view of being a permanent structure, well able to take care of the increasing and heavy traffic of the road. It has been furnished and is now being erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

THE NEW JERSEY TERRA-COTTA COMPANY has closed contracts for furnishing the following buildings with terra-cotta: Residence and carriage house, Islip, L. I., Lawrence Birdsall, architect; school, Cranford, N. J., Ackerman & Ross, architects, Peter Tostevin's Son & Co., builders; offices, 66th Street and Columbus Avenue, New York City, Neville & Bagge, architects, Robinson & Wallace, builders.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., are building a new boiler-house roof for the Coe Brass Manufacturing Company, at Ansonia, Conn. The Hartford City Gas-Light Company, of Hartford, Conn., have placed with them an order for one of their steel roofs lined with their patent anti-condensation fire-proof roof lining, which has given such eminent satisfaction in the past.

THE RIDGWAY PRESS-BRICK COMPANY, Ridgway, Pa., have closed the following new contracts for supplying their bricks: 40,000 light mottled Romans and 3,000 dark mottled Jack arches for Harre Robbins's residence, Pittsburgh, S. F. Heckert, architect; sale made by Jas. R. Pitcairn, Pittsburgh representative; 200,000 vitrified gray standards and 2,000 vitrified gray bull noses; power plant for Northwestern Mining and Exchange Company, Brockwayville, Pa.; 100,000 vitrified buff brick for factory building for Wilcox Manufacturing Company, Wilcox, Pa.

TERRA-COTTA KEY, ST. JAMES BUILDING, NEW YORK CITY.
Executed by the Perth Amboy Terra-Cotta Company.
Bruce Price, Architect.

The Clinton Metallic Paint Company, of Clinton, N. Y., are sending out in little white enamel boxes, scarcely larger than a postage stamp, samples of Elastic Silk Fiber Roof Cement. This is said to be a strictly up-to-date article, combining unusual elasticity with adhesiveness, and a special value is given to it from the peculiar fiber it contains. Its qualities admit of its working in any climate, and on either metal, slate, or glass, and the white enamel boxes which the Clinton Company are sending out are a unique departure in sampling, in the roof cement trade, at least.

From building reports which have recently come to hand it is noticeable that Powhatan white bricks are to be used liberally in New York building operations. Among the buildings which are to be constructed of these bricks are: The new Hall of Education; apartment houses on 87th Street west of Park Avenue; building corner 92d Street and Madison Avenue, N. L. & L. Ottinger, architects; new building for the Knickerbocker Realty Improvement Company, 116 West 34th Street; new building on 125th Street near Amsterdam Avenue, Pollard & Steinam, architects; new building at 3d Street and Avenue C, Harry McNally, architect.

The product of the American Mason Safety Tread Company is being specified for use in a very large proportion of the buildings now in the hands of Boston architects. The Safety Tread is to be placed upon the stairs of the Southern Union and Dartmouth Street railroad stations Shepley, Rutan & Coolidge, architects; the new building of the Massachusetts Institute of Technology, E. B. Homer, architect; the Paul Revere School, Peabody & Stearns, architects; the West Roxbury High School, Andrews, Jaques & Rantoul, architects; the East Boston High School, J. Lyman Faxon, architect; Melrose High School, Tristram Griffin, architect; the Brayton Avenue School, at Fall River, A. M. Marble, architect; school at East Douglas, Clarence P. Hoyt, architect; Massachusetts Eye and Ear Infirmary, Shaw & Hunnewell, architects; Masonic Temple, Loring & Phipps, architects; large buildings of the Boston Real Estate Trust on Beach Street and of the Francis estate on Chauncy and Avon Streets, Winslow & Wetherell, architects; India Street building, Alex. S. Porter, Trustee, Charles E. Park, architect; India Street building, John D. Long, Trustee, Rand & Taylor, Kendall & Stevens, architects; and several other large buildings for mercantile uses. The approval of the Mason Safety Tread by Prof. F. W. Chandler for use in the Institute Building, and, as consulting architect for the city of Boston, for the important new public school buildings, is significant of the favor with which this modern protective device is received by professional men of the highest standing.

A new and beautiful thoroughfare has been added to the several leading to Thomas Park and Dorchester Heights, Boston, which is not only in keeping with the general surroundings, but adds greatly to this beautiful spot, says the Boston *Herald*.

This new thoroughfare is to be known as Covington Street, and its unique construction and general appearance for a thoroughfare make it something of a curiosity, as regards the laying out and construction of public thoroughfares.

It shows that although a grade may be very steep, it is possible to overcome it, as far as pedestrians are concerned; for this new street is constructed with artificial stone blocks arranged in a series of flights of steps, with a broad landing of the same material between each flight, making it easy and convenient to surmount.

In starting the work, flights of steps were cut out of the earth embankment. These steps were then covered with a surface of broken stone and cement, so that when the stone steps should be placed in position it would be impossible for any damage to result from cold or frost.

There are seven flights of stairs containing nine steps each, and between each flight is a landing about 6 ft. long and 12 ft. wide, the entire structure being constructed of artificial stone composed of crushed granite and cement.

The W. A. Murtfeldt Company, of Boston, did the work, and the cement used by them was the Dyckerhoff brand.

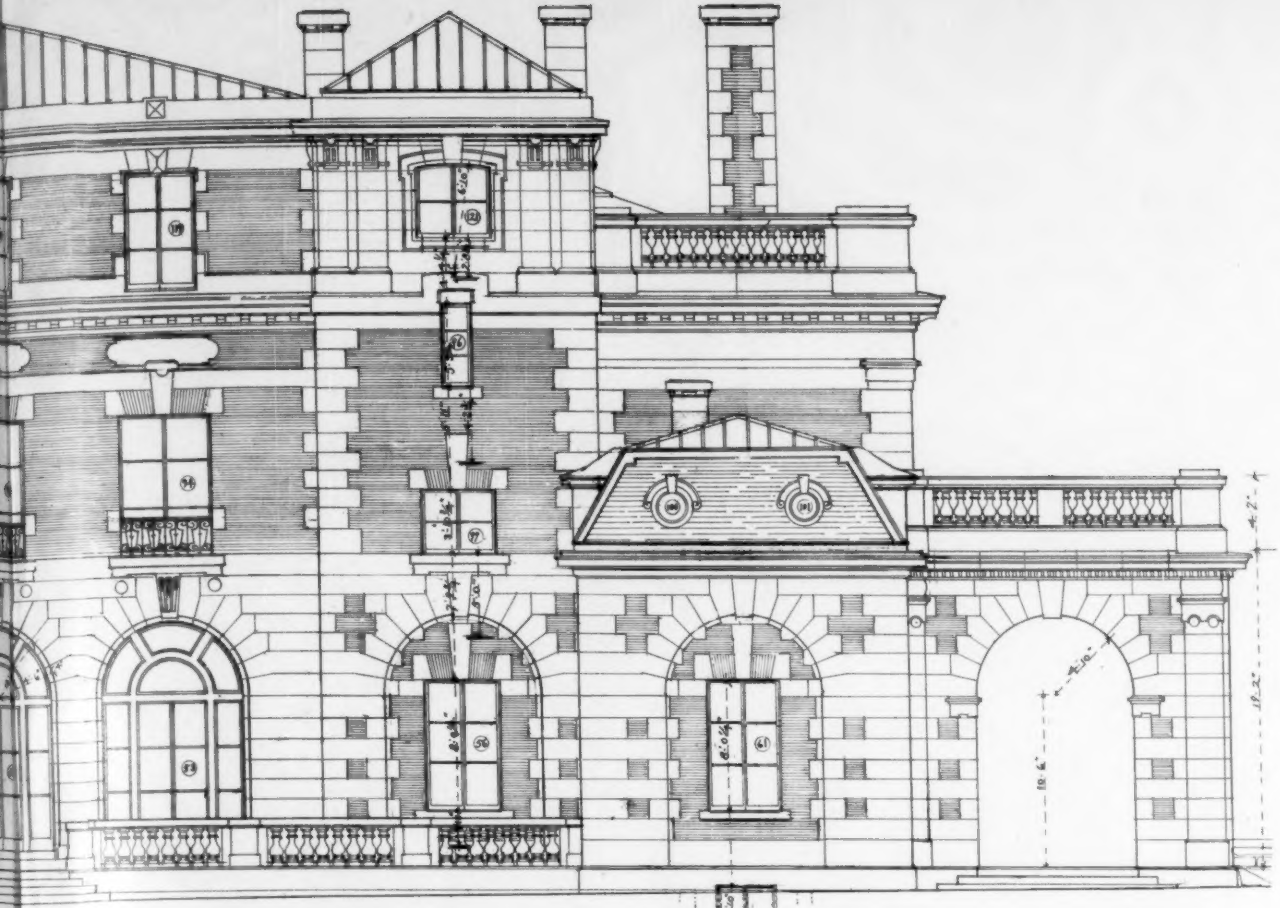
WANTED,

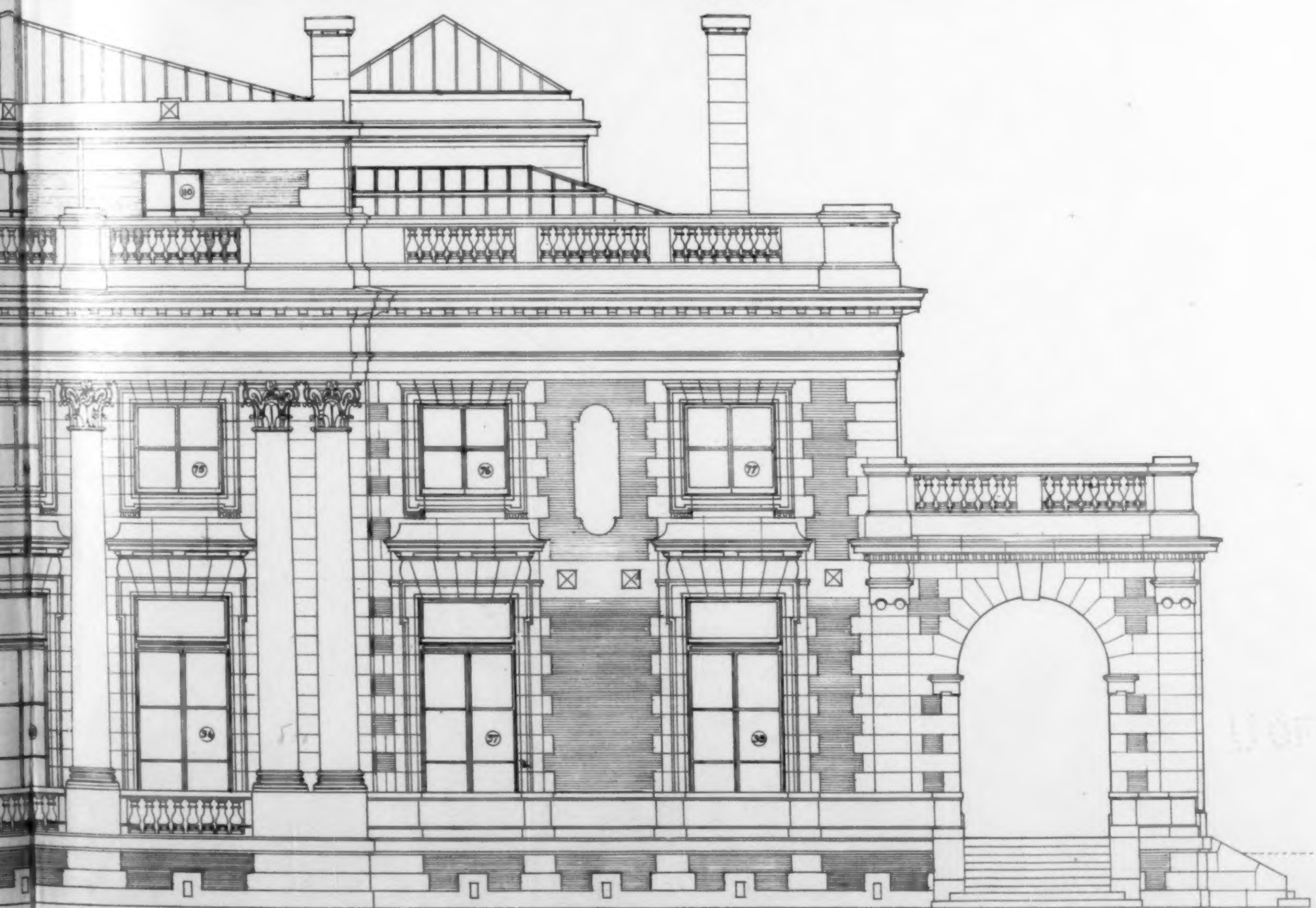
For New York or Western office, a couple of strictly A1 draughtsmen, one good free-hand sketcher, designer, and water colorist; also good man for working drawings and details. Must be rapid, accurate, and capable. Permanent positions to right men. Address, stating salary expected, W. J. KEITH, Architect, Minneapolis, Minn.

HOUSE FOR GIRAUD FOSER, Esq

CARRERE & HASTGS, Arc

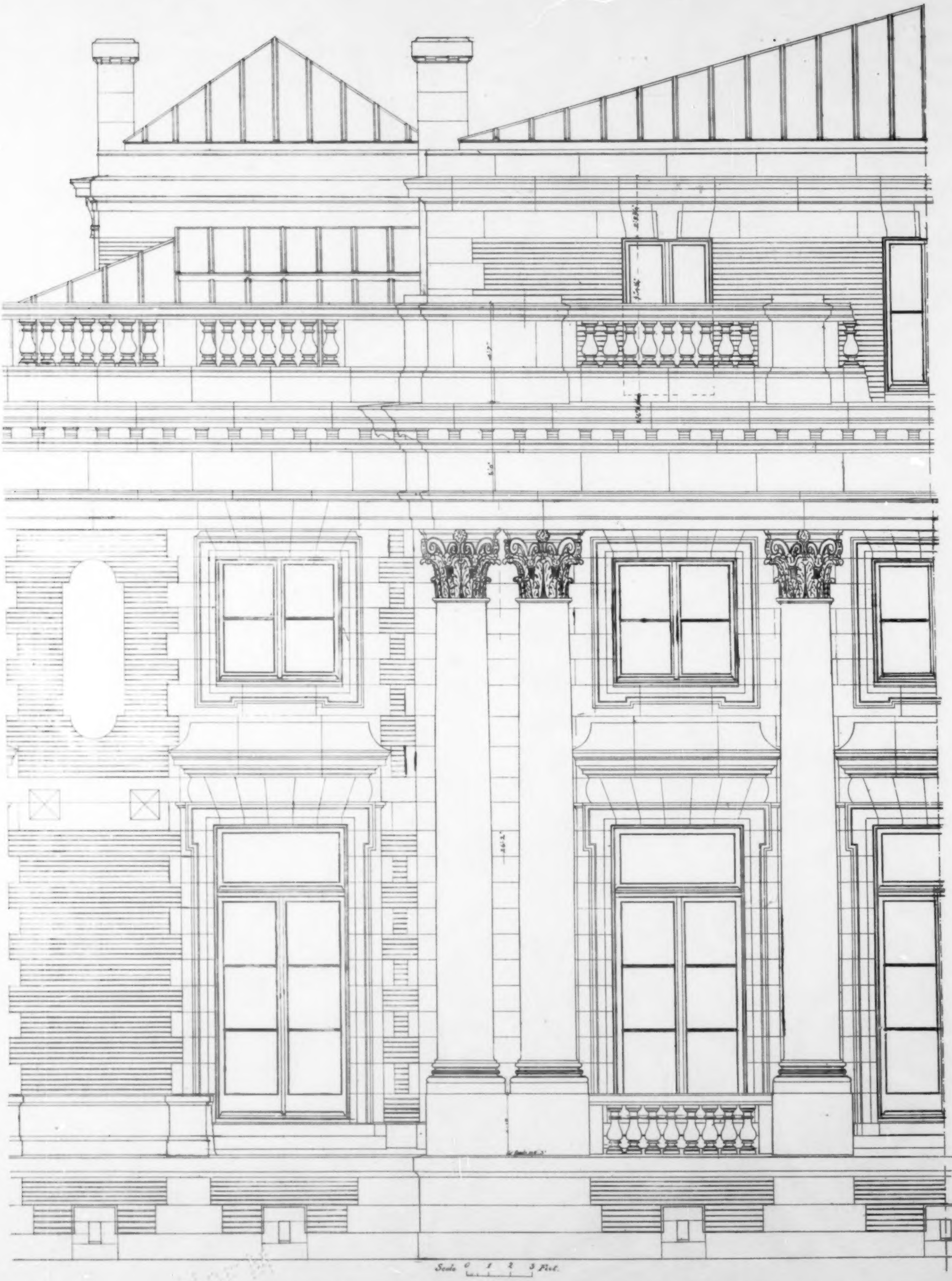
PLATES 17 and 18.





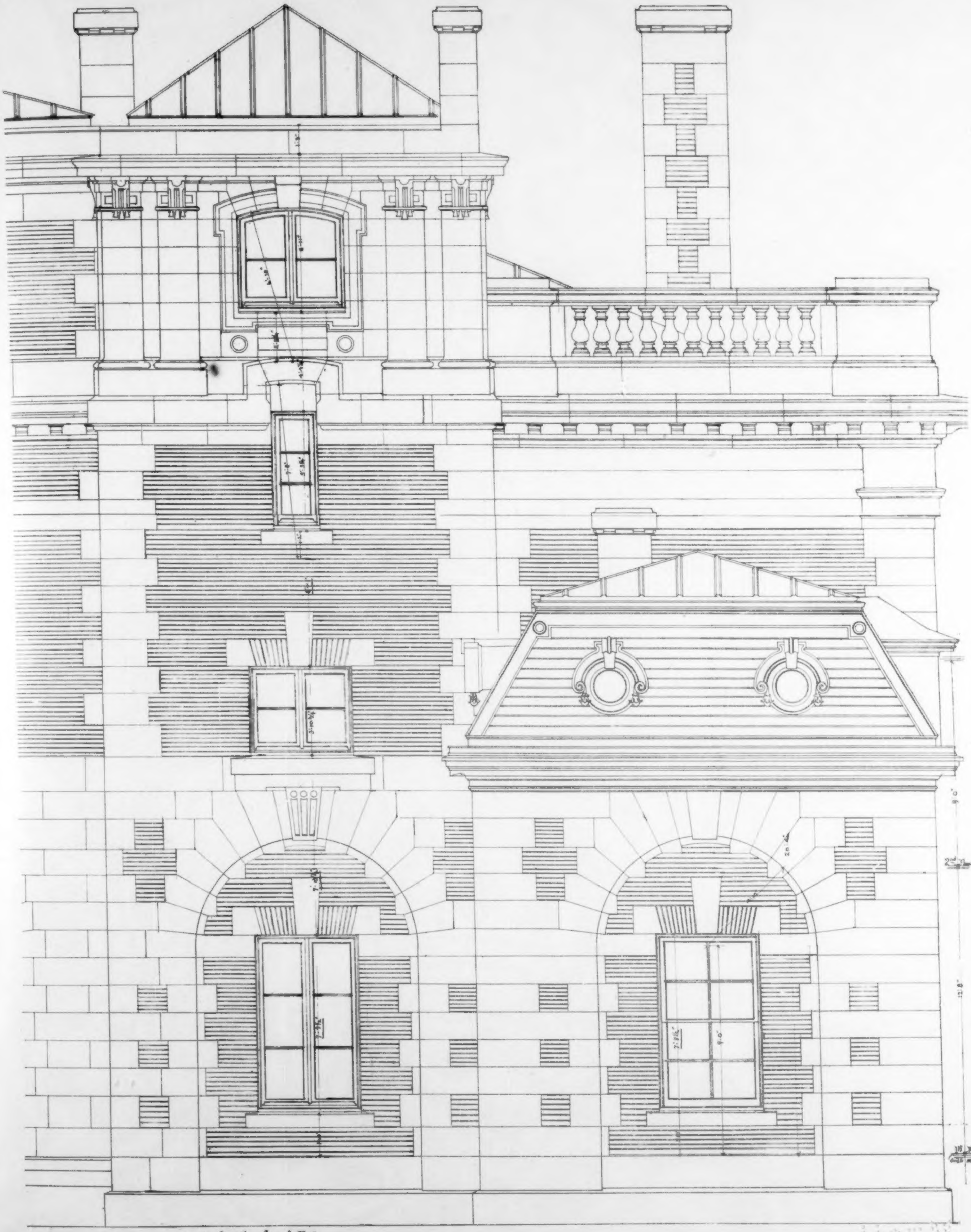
FOSER, Esq., LENOX, MASS.

HASTGS, Architects.



DETAIL OF PORTICO, HOUSE FOR GIRAUD FOSTER, Esq., LENOX, MASS.

CARRERE & HASTINGS, Architects.



DETAIL OF NORTH ELEVATION, HOUSE FOR GIRAUD FOSTER, Esq., LENOX, MASS.

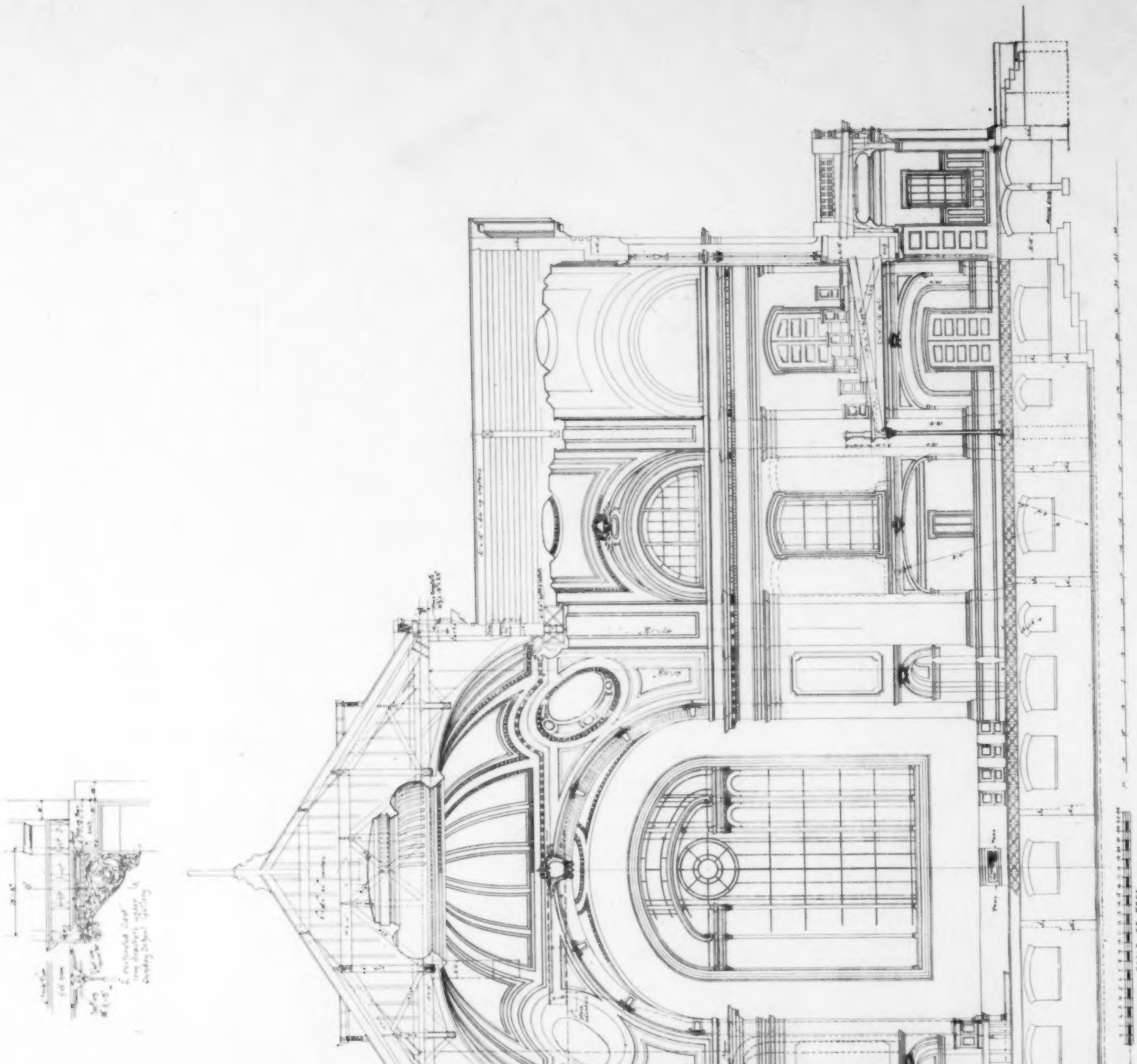
CARRERE & HASTINGS, Architects.

CHURCH AND PARISH HOUSE, CONGREGATION

ERNEST FLAGG, Architect. GEORGE

GREGATIONAL SOCIETY, HARTFORD, CONN.

GEORGE M. BARTLETT, Associate.

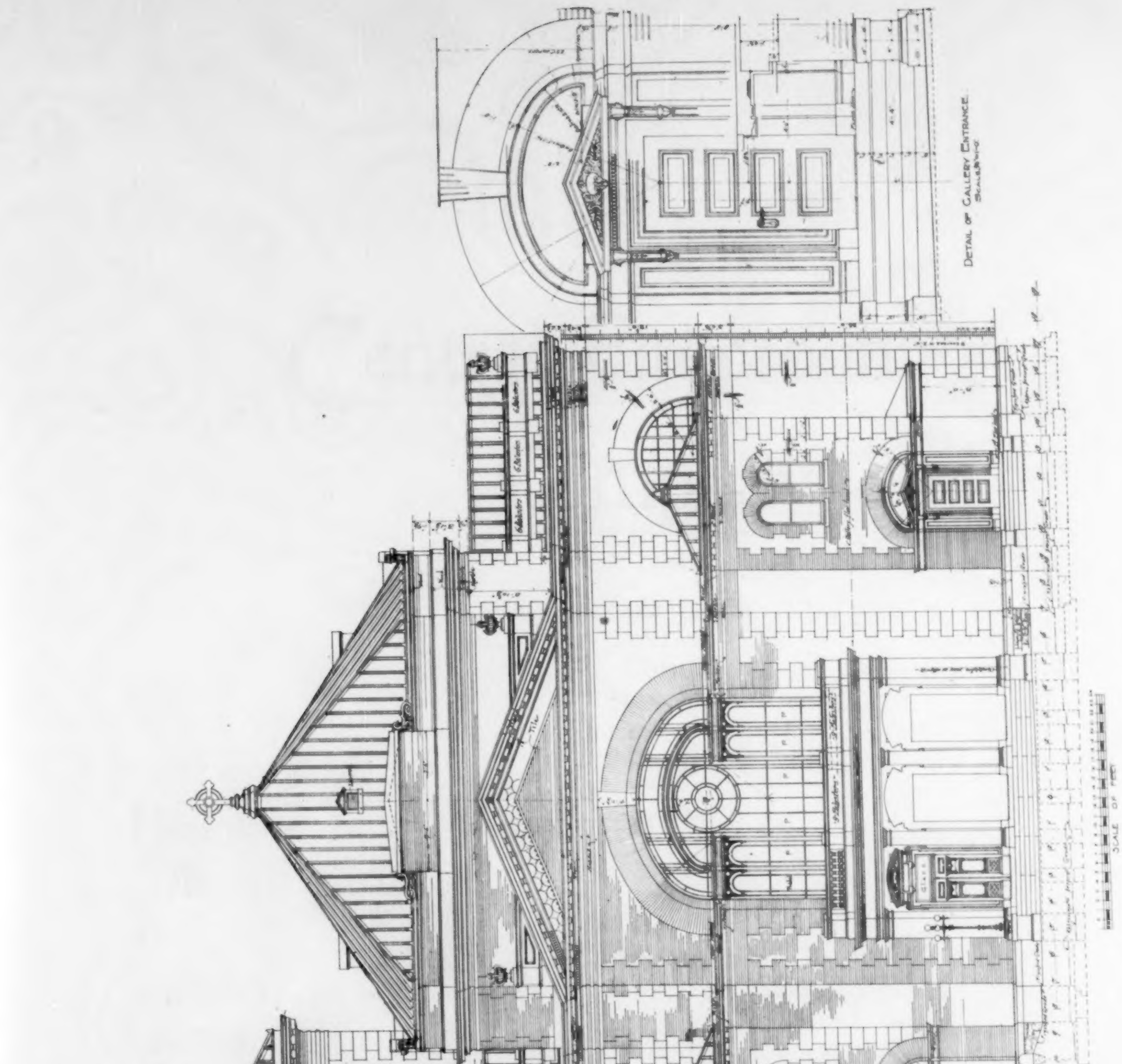


SECTIONAL VIEW.

CHURCH AND PARISH HOUSE, HARTFORD, CONN.

ERNEST FLAGG, ARCHITECT. GEORGE M. BARTLETT, ASSOCIATE.

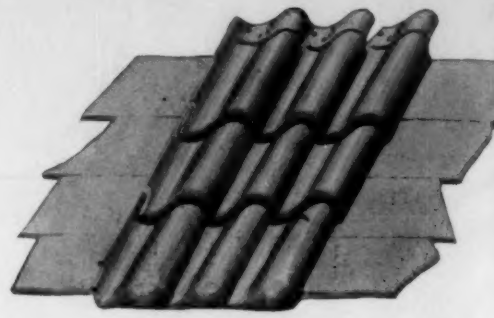
VOL. 7. NO. 3. PLATE 24.

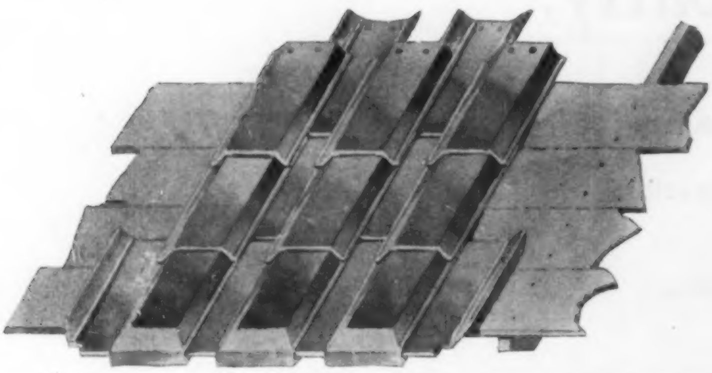
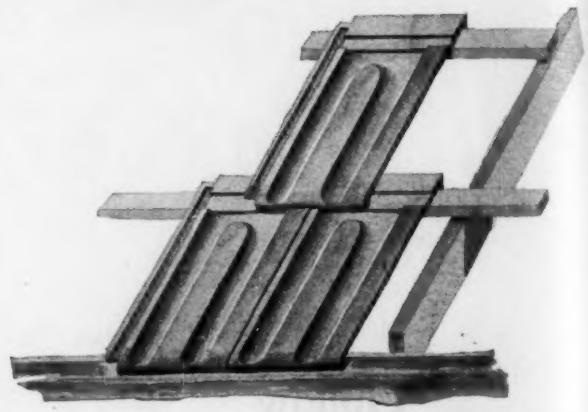


FARMINGTON AVE. (SOUTH) ELEVATION.

CHURCH AND PARISH HOUSE, HARTFORD, CONN.

ERNEST FLAGG, ARCHITECT. GEORGE M. BARTLETT, ASSOCIATE.

THE DELMONICO BUILDING, 44TH STREET AND FIFTH AVE., NEW YORK CITY.
JAMES BROWN LORD, ARCHITECT.